MEMO FROM MERCURY:

INFORMATION TECHNOLOGY *IS* DIFFERENT

Gordon B. Thompson

Occasional Paper No. 10

INSTITUTE FOR RESEARCH ON PUBLIC POLICY/INSTITUT DE RECHERCHES POLITIQUES
3535, chemin Queen Mary, bureau 514
Montréal, Québec H3V 1H8

June 1979

Z
697
146

© Institute for Research on Public Policy 1979
All rights reserved

ISBN 0 920380 29 8

Legal Deposit Second Quarter
Bibliothèque nationale du Québec

PREFACE

A widely accepted and seldom questioned diagnosis of society concludes that the information society is already with us or just before us. Whether this is true within the North American environment is a matter for debate; but it is a fact that in Japan it is fast becoming a reality. To the Japanese, the "information society" is a social concept comparable to the concepts of agricultural society and industrial society, and they have committed significant sums to ensure it will come to pass in an orderly manner. In other words, the information society is viewed as an inevitable future society that is to follow the industrial society; a society that is new and being made possible through an information revolution centred on computer and communications technology; a society that will flourish through the usage of the information utility.

The information utility is a relatively new concept emerging from the wedding of computers, communications, and automation, and it is a phenomenon truly transforming technology in a way that will change our lives profoundly. To some, Daniel Bell, for example, it seems we are on the threshold of developing a new society on the basis of the production of information, in place of the production of material goods. So it is not surprising that IRPP's work on the current and future impacts of such changes on Canada is focused on this arena.

A cluster of probes has been produced so far. Robert Russel, *The Electronic Briefcase: The Office of the Future*; W.E. Cundiff and Mado Reid, *Issues in Canadian/U.S. Transborder Computer Data Flows*; C.C. Gotlieb, *Computers in the Home. What They Can Do for Us--And to Us*; and J. Michael McLean, *The Impact of the Microelectronics Industry on the Structure of the Canadian Economy* precede this study.

As another contribution to the issue, Gordon B. Thompson's report attempts to show in what ways information technology fundamentally differs from industrial technologies. Gordon Thompson, an engineer working for Bell Northern Research, is a man of wit and original mind, and can be counted on to add to the liveliness of the debate.

Michael J.L. Kirby
President
April 1979

CONTENTS

PREFACE iii

EXECUTIVE SUMMARY/ABRÉGÉ vii

INTRODUCTION 1

1. THE TECHNOLOGIES 5

2. THEN AND NOW 11

3. THE HYPOTHESIS 19

4. INFORMATION AS AN ECONOMIC GOOD 23

5. THE INFORMATION MARKET-PLACE 29

6. ELECTRONIC MEDIA AND THE INFORMATION MARKET-PLACE 35

7. THE OTHER CONSTRAINT 43

8. A NEW MASS MEDIA 51

CONCLUSION 59

BIBLIOGRAPHY 61

EXECUTIVE SUMMARY

The new is usually perceived in terms of the old. Just so is the new information technology perceived as a product of industrial technology. But some social economists claim that this new technology, the automatic production of information by computers, will have greater economic and social impact than the Industrial Revolution. In ten chapters, this report introduces information technology, explores constraints on its use and development, and describes it as a new technology that could be used in creative ways to ameliorate our present condition.

The introduction presents a short overview, then follows with the notion that fundamental constraints seem to be inhibiting demand, and thus full use, of the new technology. These demand constraints must be addressed if the technology is to achieve its full potential.

Chapter one establishes some basic differences between industrial and information technologies. Industrial technology with its high capital and productivity requirements reinforced the ideas of "economy-of-scale," "bigness-is-good," and centralization of skills and labour. The immense productivity benefited most members of society, if not as shareholders, as consumers and wage earners.

Information technology moves away from these concepts. Basic physical laws limit the size of practical information machines. Also, direct access to information technology is possible, as unrestricted access to massive, complicated industrial means of production is not. A third important distinction involves the means by which labour is converted into capital.

The concept of conviviality is used to describe the utility of a tool as perceived by ordinary people. Heavy industrial technology is not convivial, while telephones and CB radios are. The growth of hobby computers and computer-based television games suggests that computers are undergoing a conviviality re-evaluation.

Chapter two shows how the trading ethos, established under the mercantile system, grew and prospered with the adoption of industrial technology. A model is proposed, with commerce, polity, philosophy, and finance forming a mutually reinforcing, positive-feedback system that has thrived for over four hundred years. When the combination faltered two hundred years ago, industrial technology injected new life, but led to a greater intensification of interdependence and mutual development.

Such a feedback process will expand until it becomes unstable or saturated. The saturation of our industrial system is demonstrated with five dilemmas. The *growth dilemma* is the continued need for economic growth, coupled with an inability to achieve it due to resource constraints and environmental consequences. The *control dilemma* arises from the need to plan and our abhorrence of centralized control. The *distribution dilemma* pits the cost of sharing the earth's resources equally among all nations against the consequences of not sharing. The *job-roles dilemma* involves eliminating jobs through technology, yet coupling personal worth with jobs. The *affluence/scarcity dilemma* applies to a society whose members must be convinced of a scarcity of possessions in spite of bountiful output.

The dilemmas stem from the successful application of industrial technology. Perhaps the application of the new information technology will allow us to avoid these supply or resource constraints.

Chapter three begins by defining technological innovations in terms of the impacts they can have on socio-economic systems. The intensive class of innovations results in an intensification of already existing processes. The extensive class is transformative and characterized by doing new things in new ways.

An hypothesis is then formulated: only the intensive, or first-order impact, class of innovations is working; the extensive class, with higher-order impact and transformative interactions, is somehow inhibited. A pluralistic approach like that used many years ago in solving the problem of determining longitude at sea is recommended for discovering how to move beyond the constraints inhibiting extensive innovations. There seem to be fundamental demand constraints based on our centuries-old experience in the trade of goods and our dedication to the application of industrial technology.

Chapter four explores the concept of information as an economic good. Where information markets do exist, information is usually classified as a "public good." Two examples from Britain demonstrate how the information technology itself can define the public or private state of a good. The Teletext system broadcasts its entire library to its receiver, displaying the information on a television screen. The Videotex system delivers only requested information via the telephone network to its receiver for display on a television screen. By making the content of the Teletext broadcast a public good, billing for use, beyond a flat rate, is difficult. The Videotex system however, offers its content as an exclusive private good, opening the way for the establishment of a proper market.

Trading a public good in an open market generates additional external costs not covered in the original exchanges, which must be dealt with outside the immediate theatre of transactions. For example, operating in a market with information that is a public good generates the additional external cost of a system to protect the author's rights to the information. Information as a private good would not incur this cost.

The costs to society of inhibiting the development of a private-goods information market may not be apparent yet. The real sources of wealth creation in an information society are still evolving. Our perceptions of economic utility have not yet moved beyond the constraints formed by four centuries of trading in physical goods.

Chapter five develops the concept of an information market-place where information is traded as an economic good. In a low-price, high-usage approach, consumers would pay a flat rate for unlimited access to information, and authors of information would compete for the consumers' attention (the good traded). In a high-price, low-usage approach, consumers would pay selectively for private information. Information as a private good, with authors competing for consumers' revenue, would require, as well, entrepreneurs who, as a service, could broaden perceptions of the utility of information packages and expand the market. The technological environment needed to support the information market-place would also support our economic market-place. The pluralism inherent in the information market-place is a key to unlocking the constraints inhibiting the application of the new technology in socially beneficial ways.

Chapter six explores television as a potential medium in the information market-place. Two developments might increase its present low conviviality: mass audience response facilities, such as instantaneous polling of viewer reactions; and a demand television system sensitive to usage, which would diffuse revenues and benefits throughout a wide group of contributors of content. Television could play a significant role in the low-price, high-usage of the information market-place. A new mass medium, where an infrastructure encourages the interaction of communications facilities, computers, and intelligent terminals in a synergistic way, will be more than an extension of television. Conviviality will be high, since the new medium will produce recallable, specifically tailored material for an active participant in the system.

Chapter seven describes two pluralistic approaches using information techniques that could remove linguistic constraints on machine use. Finding information in the system, when the users do not know exactly how to formulate a request, can be aided by a strategy network the author calls a serendipity machine. The maps created by users as they browse through a system allow the machine to calculate what information to present next. Also, kindred users can be identified and communications links between them established.

A more straightforward approach to linguistic constraints would be an ideographic rather than a phonetic language. The new technology can teach the new ideographic language and adopt new symbols as necessary. The simplistic graphic capability of computers would concentrate attention on the content of the language, not the calligraphy, thus preserving conviviality. Agreement among users on a code for the symbols would dissolve linguistic barriers to communication.

Chapter eight analyses the potential impacts of the new medium using an assessment instrument based on six criteria: ease of access to stored human experience; an increase in shared information space; an increase in shared new ideas and nascent consensus; the range of impact across a continuum from social welfare, economic opportunity, economic necessity, to survival; the potential for creating wealth in society; and the impact on personal time budgets. The new medium, by all criteria, is found to have a significant potential for being the basis for a communications revolution.

The new technology could be used to shift economic activity away from exchanging hard goods to exchanging ethereal goods like information. Such transactions would allow a continuing increase in economic activity, thus redressing the problems posed by the five dilemmas.

virtual marketplace

The conclusion reviews the argument for optimizing the socio-economic benefits to be gained from fully developing information technology. It concludes that, if the demand-inhibiting constraint hypothesis is valid, then great care will be necessary to ensure that the utility for the average person is stressed. The technology can be used in imaginative ways to ameliorate our condition. If the new technology is applied in old ways, we will only exacerbate our problems.

INTRODUCTION

The new is usually perceived in terms of the old. Just as in the early days of the railway, when the engines were called "iron horses," so we have named computers in a way that suggests that they are merely some kind of number cruncher. With good communications, the computer becomes something new and very powerful. This combination, which is without precedent, is the basis of a new technology, the son of industrial technology, from whence it grew. Like a son, it can be developed to be just like its father, or it can be encouraged to achieve its own unique potential.

Modern semi-conductor production techniques make something that contains thousands of components cost about as much as a single component device. Electronic intelligence can now be mass produced for mere pennies. Already the impact of this development has hit the market-place. Sewing machines and cash registers now use this technology instead of cams and gear wheels. The personal computer can now be purchased for under a thousand dollars.

Standing, as he did, at the beginning of the Industrial Revolution, Adam Smith did not really foresee the magnitude of the impact of that revolution. He identified the essential economic processes, but failed to see the incredible growth potential of those processes.

Today, Yoneji Masuda (1975), the Japanese social economist, is in almost the reverse position. He perceives an impact from information technology that is even greater than that of industrial technology, but is not too clear about the economic processes that will be involved.

Social economists study the conditions that produce economic revolutions. Masuda claims that a new world view, when coupled with a new means of production, results in such a climacteric. He points to the emergence of the ecological, "spaceship earth," humanist view that is now overtaking the "coercer of nature" view of man as the new world view. The "automatic production of information" by computers is the new production means he identifies. These, he claims, are the basis of an economic change that will be greater in impact than the Industrial Revolution. Unlike Smith, he foresees the impact, but only dimly perceives the processes, for his approach to information economics is just that, only an approach.

Edwin Parker (1976) says that the United States is now in the midst of a transition from an industrial society to an information society. He points to shifts occurring in the components of the national income statistics and changing trends in personal consumption to illustrate this notion.

Marc Porat (1977) reaggregated the U.S. labour statistics to add an occupation classification beyond the usual three of agriculture, industry, and service. He separated out those activities involving symbol processing and the manufacture and support of machines that manipulate symbols. The result of that reclassification showed that more than 53 per cent of the U.S. wage dollar was going to people engaged in information sector occupations. Roughly speaking, there are today twice as many information workers as there are either industrial or service workers. In the pre-World War I era, the agricultural worker dominated, From then until somewhere about 1960, the industrial worker was the most prevalent, Since that time, the information worker has been most numerous, representing today about half the labour force, with the remaining half made up of about equal portions of industrial and service workers. At considerably less than 5 per cent of the total, the agricultural worker hardly rates mention.

Even if Masuda's forecast is only partly correct, why are things not better than they are? Why is it that our economy seems so moribund in the presence of a new technology of such potential? By comparing the period when industrial technology was new to today, some insights are generated into how this new technology might begin to transform that economy.

In the following chapter, we shall examine some of the differences between industrial technology and information technology. In so doing, we shall establish a sense of which is which. Unfortunately, the distinction is not clear, and there are many cases that have both sets of characteristics. We are really dealing with the "fuzzy sets" kind of logic, as opposed to the simpler and much neater Aristotlean "either-or" logic.

Chapter two attempts to do two things: first, indicate the economic opportunity that may exist for well thought-out and suitable strategies, and second, show how far short of this potential our present uses of this technology are falling. Chapter three establishes the key hypothesis: industrial technology and its related socio-economic transaction patterns have become supply or resource constrained, while information technology and its accompanying processes are demand constrained. On the surface, this seems an easy statement to make, for whenever something new is encountered, one must await demand buildup. However, this is *not* the constraint toward which we are leading, and here lies the important aspect of this study. Significant demand in the case of information technology seems constrained for some very fundamental reasons. If this is the case, then these constraints must be addressed if Masuda's optimistic predictions are to really happen. The unusual treatment of innovation directly leads to the demand constraints.

In chapter four, information is examined as an economic good, and it is suggested that we have some rather strong notions that may have to change before we can fully benefit from this new technology. These particular perceptions are one of the demand constraints that need redressing.

Chapter five proposes an information market-place as an action, based on the principle of pluralism, to address the demand constraints. A parallel is developed between the solution to the demand constraint problem and that of determing longitude at sea.

Television is examined as a potential vehicle for the market-place concept in chapter seven. A new complementary medium is proposed, one that would be more convivial in Illich's sense, Several strategies that would make these two media work together in mutually reinforcing ways are put forth.

The remaining chapters develop the characteristics one might expect to see in a new medium, under the assumption that the constraints mentioned earlier are operating. The probable nature of the constraints is examined and this is used in building the description of the new medium.

In the face of all the shiny technological marvels that may appear as time goes by, we must not loose sight of the basic argument: there seem to be fundamental constraints acting to inhibit the buildup of really important demand pull, constraints that could limit the use of this new technology to an endless round of calculators, digital watches, and other "industrial mode" applications. Without detailed knowledge of any such demand constraints, Masuda's vision may well remain forever just a vision.

Winner (1977) observes that "man has a choice between authoritarian megatechnics and democratic polytechnics." Perhaps this new technology offers the option of democratic megatechnics. This could be the new opportunity. A new means of production and a new economic good. And so a new order. The technology will not drive us there. It will only *not constrain* our efforts to go there.

Chapter One

THE TECHNOLOGIES

Early in the life of the Industrial Revolution, the technology used grew larger and heavier, and so the "economy-of-scale" effect was discovered and validated. Productivity increases were seen to vary directly with the size and capacity of the production engines, and heavier and heavier tooling evolved. Although this had a tremendous pay-out to society through increased productivity, it also brought a cost in terms of adaptability and flexibility.

The very large start-up costs tended to reduce the number of players in any one activity arena and also the chances of new entrants appearing. As this syndrome grew in strength, the tooling used by the successful players became more and more specialized in order to gain still further increases in productivity. This specialization reduced even more the chances of upstarts unseating the large and established operators. Thus the massiveness and specialization of the production tools and the attendant high costs led to a kind of natural protection that permitted even further increases in massiveness and specialization of facilities. Productivity increases were realized with each iteration of the process. The cost of this was the firm entrenchment of heavy specialized technology and its attending infrastructures.

Perhaps the automobile industry best illustrates the extent of the growth of massiveness and rigidity of the technology. Technological advancement in automobile power-plant production is constrained by the large investment in specialized and massive production facilities dedicated to current designs. The situation got this way because there was real utility in going to very special and massive tooling. Low per-unit costs have been achieved at the expense of adaptability.

Industrial technology tends to reinforce the notion of "economy-of-scale" or its running mate, "bigness-is-good." The acceptance of these ideas grew with the continued success of using them in applying industrial technology. This produced some very large things ranging from aircraft to buildings, from power plants to cities. The depth of industrial society's dedication to the big-is-beautiful notion is only now becoming apparent, as such alternative philosophical views as small-is-beautiful and appropriate technology become more widely known and appreciated.

Besides the economy-of-scale and bigness-is-good twins, the application of industrial technology encouraged centralization. Unless the individual craftsman was prepared to mortgage his soul, he was put out of business by the increased productivity and high capital investment associated with the newer production methods. He had to pursue another vocation, or work in the mill, where his old craft had been collected and centralized. The vast majority of innovations associated with the industrialization of western society had this centralization characteristic. Labour in quantity can only be replaced by a machine when that labour's work is brought together or centralized.

As industrial technology increased in complexity and capital cost, the organizations required to squeeze out the benefits became increasingly large, complex, centralist, and expensive. The large corporation was a natural companion to the heavy, bigger-is-better, centralist technology of industrial society.

The economic results of a business activity may be concentrated and, so, easy to tap; or they may be diffuse and extend widely throughout the society, and hence be rather difficult for the entrepreneur to fully exploit. A business strategy that appears to have concentrated pay-out will be selected for development over one whose returns are perceived as being diffuse, even though they may be larger in total. The entrepreneur will tend to leave the latter "opportunity" to the public sector to develop while applying his interests to the former area.

Because of its very nature, industrial technology tends to favour the development of those structures where the economic benefits are concentrated. The cottage industry pattern gave way to the factory. Higher levels of productivity could be achieved with concentrated, rather than diffused, tooling. Ownership of the production means became more and more concentrated. The primary benefits or revenue streams that result from the application of industrial technology never flow directly to the average industrial-society citizen. Albeit the benefits are eventually diffused to everyone, the direct rewards are concentrated into a small minority of the citizenry.

The propensity to develop only those activities where the rewards were concentrated presented little difficulty in the heyday of industrial technology. That technology was essentially concentrated and centralist itself. These notions found acceptance in the society at large. Hence, the philosophical leanings of the entrepreneur as a member of a particular culture, that culture's leanings, the economics, and the technology were all in accord. The immense productivity that resulted afforded a very large real benefit to most members of the society, if not directly as shareholders, at least indirectly as wage earners and consumers.

Information technology differs from industrial technology in that the economy-of-scale idea cannot be profitably applied beyond some minor level. Basic physical laws relating to information propagation velocities, physical size, cooling requirements, and "housekeeping" needs tend to limit the size of practical information machines. By linking individual machines into networks, a sort of distributed machine of very large capacity can be built: the telephone system is an example of just such a configuration. Small computers continue to grow in computational power and shrink in size, cost, and mechanical complexity as newer designs appear. It was never this way with power shovels or punch presses! Information technology moves us away from ideas of economy of scale, big is beautiful, centralization, and concentration of benefits. Information technology is inherently different from industrial technology.

The inappropriate use of the big-is-beautiful idea in applying information technology has produced some mongoloids. The "computer utility," an idea from the early development period of information technology, was clearly based on the structure of existing industrial public utilities, and exhibited the heavy, centralist, structural notions of the older technology. For many real and valid reasons, there will never be a collecting together of "raw computer power" into one giant, centralized machine serving a whole country or, for that matter, a whole city. The big-is-beautiful idea applies to information technology in a very small, weak fashion.

These two technologies differ in a second manner. There is no way an ordinary citizen could walk into a modern industrial factory and use its facilities to construct something useful for himself. Giving the public direct access to the means of industrial production would produce nothing but mayhem, and reduce the availability and utility of those tools to virtually zero for the bona fide users. Those massive and sophisticated tools are just too complicated, and the procedures required to gain utility from the use of the tools are both so fragile and complex that only carefully directed personnel can be allowed to work with them. In addition, there is an aspect of personal danger associated with the use of these industrial production means, and those who work with the production machines must be trained to work with them in such a manner as to preserve their personal safety. Hence, direct access to industrial technology production means must be carefully restricted. Information technology is quite different.

Every time we pick up a telephone, we directly access one of the largest and most complex examples of information technology. It is just as if we were led right into the factory, for we are in control of what that machine does.

A third important distinction between these two technologies involves the means by which labour is converted into capital. In a society based on industrial technology, there are few, if any, mechanisms for the direct conversion of one's own labour into capital, capital that is recognized as being such in the society at large. The various land-settlement acts that were employed to induce settlement in North America a century ago were such a mechanism, for a settler could labour for a few years and so earn the title to the property he was living on without paying rent or a purchase price.

Invention is the only industrial technology process where labour can be converted to capital directly. By labouring at the invention of a super mousetrap, a design can be created and sold to a mousetrap producer for a great sum of money. The labour of producing the design is thereby converted into capital. At least, that is the romantic view of the process. Labour converted directly into capital is vastly different from mere wages.

Unfortunately, the day of the individual inventor is long past. Invention is now a very organized business, and is far too complex for the solitary inventor in his lonely "garret laboratory." Furthermore, one cannot claim that the successful inventors of yesteryear were in any way average citizens. Today, conventional industrial technology offers virtually no opportunities for the average citizen to convert his own labour directly into capital.

If and when information itself becomes a significant economic good, then those that labour to produce it will be able to directly convert their labour into capital if a simple royalty scheme is used to provide revenue to such authors. The royalties received from a particular piece of work would resemble interest payments earned by a block of capital. In this case, the block of capital is mythical, but the interest payments or royalties are not. The effect is as if a block of capital were created during the author's period of labour. Capital is classically defined as "stored labour." The whole idea is to recognize the act of creating useful information products as "honest" labour, in the economists' fundamental sense.

This is not a totally new notion, for today's music composers, in fact, do operate just this way. Galt MacDermot laboured for two weeks creating the musical score for "Hair," and has received ever since royalties every time that music was played over the air. His labour was turned into capital, on which the interest has amounted to something over a million dollars, according to reports. The process is not new; what is needed is a means to make the process more widely available. Music is too limiting a form to allow a significant number of people to achieve incomes by creating in that medium. However, for all that, music is a better gamble than inventing.

convivial tools

When Ivan Illich (1973) uses the term conviviality to describe a property of a tool, he is referring to the utility of that tool as perceived by ordinary people. The common hammer is, in Illich's terms, a convivial tool, as is a cook-stove.

Heavy industrial technology is clearly not convivial. A complex screw machine would have no utility for the ordinary person. The utility of the heavy complex tools of industry can be released only under certain controlled conditions. It is these conditions that most industrial corporations are designed to create and preserve.

For a thing to be convivial, it must be easy to obtain and use; it must not require significant levels of training before there is recognizable utility in its use. That is not to say that training will not produce different levels of utility, for, as in the case of the cook-stove, the gourmet's training and the harried homekeeper's experience both interact with the stove to produce utility, but different kinds of utility.

Conviviality challenges the designer to produce goods and services that are perceived as having a low capital cost of acquisition, and are seen by both the minimally trained and the particularly skilful as having wide general utility.

Our communications media, with the exception of the telephone, the mail, and the CB radio, are very low in conviviality. Participation in the inputting of the other media requires very special skills. Recent developments in technology may provide some opportunities to add to the list of convivial communications media.

Conviviality is both time varying and culture dependent. The computer, which is now very low in conviviality, may turn out to be quite high; it was so with writing. When writing was new, the symbols were complex and not related to speech sounds, but to words or whole ideas. Consequently, there were a great many symbols to learn before the user could perceive any utility in the art. Ancient societies could afford only a few specialists with the necessary skill to release the utility of early writing. With the invention of the phonetic alphabet, it became possible to train whole populations to a level of skill that provided utility. With that development, writing moved from a very low level of conviviality to a much higher one.

The present, rapid growth of the personal or hobby computer cult and the growing popularity of computer-based television games suggest that the computer may go through a similar conviviality re-evaluation. Costs are falling and utility is rising. The apparent absence of an upper bound on circuit complexity, coupled with the cost independence of that complexity, suggests that new products will appear with ever increasing electronic "smarts" for some considerable time to come. This new technology has only begun to have an impact on our lives.

Unfortunately, information technology is capable of destroying jobs in contemporary industrial society at wholesale rates. The jobs destroyed are not the nasty ones, but ones in the lower-middle pay-range bracket. In the second of two experiments on which he reports, Marc Porat (1977) illustrates that investment in information technology has a less satisfactory overall economic impact than investment in other economic sectors. This difficulty stems from our propensity to use this technology to save costs, to use it as if it were merely some new variant of industrial technology. This it most certainly is not! Like wine, new technologies cannot be held in old intellectual containers. The newer information technology cannot be optimally deployed using strategies that grew robust under the older industrial technology.

Conventional pay television is an example of an information technology system based on design concepts derived from industrial technology, where concentration of benefits is a key consideration. The revenue streams that support such a system are simple and centralist in structure, and are easily tapped for the benefit of the entrepreneur. All our "one way," mass communication media are based on this same centralist, concentrated-benefit pattern that served industrial technology so well. Radio made little headway until the concentrated-benefit scheme of selling radio time to relatively few advertisers was discovered. When this simple concentrated-benefit pattern was applied, radio grew quickly, but lost all of the conviviality it had during its earlier, more amateur days. The continuing struggle that the U.S. Public Broadcasting System has for funds clearly shows the difficulty of operating in defiance of this concentrated-benefit pattern. The programmes, however, show the advantage of moving away from the concentrated-benefit structure.

Galbraith (1977) suggests that the ethic of mass production overrides even the East-West ideological split, and that, under the regimen of commitment to the mass production of goods and the vast and intricate organizations that this requires, such ideological differences tend to disappear. If the technology is so dominating, what happens when that technological base is altered, when it shifts from industrial to information technology? Such a change necessarily involves shifting away from such concepts as man the maker, big is beautiful, centralization, and concentration of benefits towards more convivial ideas, even to the notion of convivial capitalism, where ordinary citizens have direct access to the means of production and can directly convert labour into capital.

Chapter Two

THEN AND NOW

In the first part of the eighteenth century, the mercantile trade pattern was the foundation of European wealth. Colonies existed solely for the economic benefit of the mother country. They could only trade with that mother country, all other trade being either severely restricted or prohibited. Sir Robert Walpole, while prime minister of Britain, wrote that the colonies were "the source of all our riches, and preserve the balance of trade in our favour, for I don't know where we have it but by the means of our colonies."

During the half century from 1765 to 1815, there was a population increase in Britain of some 40 per cent, no significant unemployment, and an average annual inflation rate of under 2 per cent. During this period, the economy changed from a mercantile base to one where a third of the labour force was engaged in the industrial sector, a sector that did not exist in any economic significance at the beginning of the period. Things went so well that Gilboy (1972) reports a period of rising costs and simultaneously rising real wages! She states this can happen in periods when "extraordinary industrial and technical changes" are under way.[1]

Economic growth under the mercantile system, based on the trading of materials found in nature with little or no processing, fostered the emergence of banking systems that supported and lent utility to the exchanging of goods. The development of a set of property laws protecting the ownership of goods and capital also emerged during this period. The shift from naturally occurring goods to manufactured ones was an easy one, for industrial technology merely augmented nature as the source of goods for trading, building on, and strengthening the trading ethos. The new technology slipped, like a hand into a glove, into the infrastructures built during the mercantile system's dominance, and removed the constraints that limited the economy's ability to satisfy the society's demands of it.

---

[1] In spite of our progress in the area of computers and communications and the advances in the underlying microelectronics technology, which do seem extraordinary, we have not produced a period of rising real wages! Instead, we have rising costs accompanied by rising unemployment! Clearly, information technology is not an "extraordinary industrial and technical change" in the Gilboy sense, or we have so constrained the interactions between information technology and our socio-economic system as to inhibit the interaction from producing a satisfactory economic result.

THE MODEL

Over the last few centuries, trade and the application of technology (commerce), the development of a metric and the means of applying it (finance and the whole financial infrastructure), the development of a complex set of guiding rules and regulations (polity), and the emergence of a strong, resonant philosophy can be thought of as forming a mutually reinforcing, positive feedback, four-member system, as illustrated in figure 1. In such a model, each sector feeds on the success of the other sectors; each sector is guided by the other three. The individual characteristics of the members develop in response to the positive feedback. Each of the four members bears the stamp of the others. The pressures exerted on each by the others result in what amounts to policy selection within that member. Together as a system, they grow and prosper mightily. But, like all positive feedback systems, saturation is the inescapable fate. The model fits the facts quite well.

```
                 COMMERCE
             and its attendant
                technologies

               /      |      x

              /       |       x

      FINANCE---------+---------POLITY

               x      |       /

                x     |      /

               PHILOSOPHY
```

Fig. 1

Referring to figure 1, consider first the relationship between commerce, together with its supporting technologies, and philosophy. The intense, and perhaps over, application of industrial technology we see about us today was clearly aided by the widespread and tenacious perception of man as the "tamer of nature," and its corollary vision, "man the maker." According to Lynn White Jr. (1962), this perception became apparent as early as 830 A.D., when illustrated calendars appeared showing not the usual, passive personification images of the attributes, but rather the active images of the coercion of nature. Here men ploughed, harvested, chopped wood, and slaughtered animals. Man and nature had separated and man was in control!

The adoption of the heavy plough, the replacement of oxen by horses as the means of powering that plough, and the use of crop rotation were technological developments that clearly fed, and fed on, the coercer-of-nature and man-the-maker perceptions of man. The heavy clay soils of northern Europe bent to the will of man and produced a bountiful harvest that prepared the way for the urbanization of Europe. The heavy plough and the horse collar were products of man's ingenuity and not mere copies of naturally occurring things.

The wide acceptance of the perception of man as something more than the mere chattel of either/or both his lord or his God lent credence to the notion that something could be done about the state of the world. Truth or knowledge shifted from being "revealed" to being based on the process of making. Man-the-maker, man-the-applier-of-technology gained acceptance. Individualism, empiricism, rationalism, and other schools of thought all agreed that it was this world that mattered, the here and now world, rather than the next. As the merchant class emerged, it became increasingly obvious that one could make it in this world, and so the links between commerce and the view of man were mutually reinforcing. Tolerance grew when it was seen that bigotry was bad for business, and liberalism, according to Russell (1959), flourished in the growing middle class, in whose hands commerce and industry were developing.

During the last two hundred years or more, the man-the-maker image both supported, and was supported by, the commercially successful application of industrial technology, and together they prospered. To the extent that the application of technology was successful in helping control nature, industrial technology both fed, and fed on, the man-the-maker image of man.

In cybernetic terms, this is a clear instance of positive feedback, for the philosophical view was encouraged by the results of the action it promoted. Such a process will grow exponentially until saturation is reached. For perhaps a thousand years, this symbiotic sub-system of the four-member, socio-economic system model proposed above has been feeding on itself and growing exponentially ever stronger in the western industrial societies.

Returning again to figure 1, the remaining relationship in the central part of the diagram is that linking polity and finance. As the metric used to measure success, the economic system aided in its recognition and assessment: as the motivator and enabler, it drove the commercial activities.
In its early stage, banking was espoused by the regimes of the day as a means of defraying debt, and so was protected and encouraged. The banks, through their exploitation of paper money and credit, provided the funds needed to finance the expansion of the economy. Governments passed laws that made the banks prosper. When these same laws proved troublesome, they were suspended. The polity was both positively encouraged, and influenced by, the developments in the financial infrastructure.

The remaining four relationships that form the outer circle of figure 1 are partially illustrated by the following paragraphs.

John Locke's conception of property rights represented a formal recognition of the significance of property beyond that which could be readily defended by the citizen's direct intervention. The growing importance of commerce and finance, and the relationship between them, made this delineation of rights necessary. Locke's writings were used in defence of the Glorious Revolution, for Locke laid out the specification for a reasonable government in a commercially oriented society. His basic philosophical ideas underlay the polity's Statute of Anne (1711), the first successful act to provide meaningful legislated protection for the creative outpourings of a society.

Authors were the first to benefit from the wonders of mass production, for the printing press was the first truly mass-production machine. Legislative attempts to provide protection for those who fuelled the mass-production presses began in the mid-sixteenth century and finally culminated in the Statute of Anne. Inventors did not get legislated protection until more than a century later. It was not needed until mass-production techniques were used to reproduce the things inventors created. This sequence clearly demonstrates how the commercial application of mass-production technology directly influenced the polity. As mass-production techniques were applied to various skills, legislated protection for the creators of the designs that were reproduced expanded apace.

Trade, important in the mercantile system, grew in importance with the use of industrial technology. The great productivity increases brought about by that technology needed healthy and intensive trading to find utility. Without such trading, industrial productivity would have been a sorcerer's apprentice. Industrial technology greatly increased the quantity of goods available for trade, and at the same time employed workers who could now afford to buy the goods.

As the economy's output grew, the foursome--commerce, finance, polity, and philosophy--was off and running. It had a new tune that still sounded familiar to the audience, the merchants who knew what to do with the bounty.

For over four hundred years, this mutually supportive cohabitation has thrived. When the combination almost faltered two hundred years ago, industrial technology saved the day, but led to an even greater intensification of interdependence and mutual development.

Like a good musical quartet, polity, commerce, finance, and philosophy performed in tune, with each player listening carefully to the others. The quartet spent its first two hundred years together playing the baroque music of mercantilism. During this time, each player was imprinted with the mark of the others.

Industrial technology provided new music for the quartet, and it quickly adapted to the new sound and prospered mightily, each player still responding to the actions of the others as the score moved from crescendo to ever greater crescendo. The violin player became a whole string section. The brass, the wood-wind, and the percussion players also became whole sections. The gentle music of the earlier period became the thunderous symphonic achievements of the eighteenth and nineteenth centuries. Choirs, brass bands, and cannons by the hundreds were included in the score. The crescendos were now truly magnificent.

The new music of information technology is again a new sound, one that may be closer to the baroque sound than the brash industrial one. Our musicians continue to interpret this new music in the industrial style, which is quite inappropriate to the new score. Today, the electronically amplified sounds of many small groups dominate. However, in true industrial style, the crescendos grow in intensity. The new technology has been successfully adapted to the old idiom.

THE *PROBLÉMATIQUE*

All mutually reinforcing, positive-feedback systems continue to grow until they either become unstable or saturated. Willis Harman (1977) provides impressive evidence of the saturation of our industrial system with four socio-economic dilemmas--growth, control, distribution, and job/roles--that are described in the following paragraphs.

The *growth dilemma* can be described as the continued need for economic growth, coupled with the inability to achieve that growth due to resource constraints and the dire environmental consequences of continued exponential growth. We seem to have arrived at a position where the choice is between the extremes of social and environmental disruption and exhaustion, or economic decline, unemployment, and inflation. This dilemma is like being asked whether you prefer asphyxiation or starvation.

The *control dilemma* stems from the need to guide and plan and our abhorrence of centralized control. Two examples of this dilemma can be cited, one in the area of technological innovation and one from the field of economics.

Harman argues that nearly all of our present-day problems stem from past technological successes. Recognizing this, society responded by inventing technology assessment and, in the United States, produced the Office of Technology Assessment, a Congress agency. Technology assessment is really just a "euphemism for anticipatory control." The dilemma is found in the fact that anticipatory control is interference, and such interference in the free enterprise system, although seemingly imperative, is avoided because it jeopardizes certain basic freedoms that were difficult to achieve.

Galbraith (1975) raises the same dilemma. Large concentrations of power in our economic system, such as large labour unions, cartels, and multinational corporations, have so perverted the system that intervention becomes ever more necessary, again intervention that we shun. When a Canadian prime minister observed that Canada no longer had a free enterprise system, implying that intervention was a fact of life, the howls of the free enterprise purists were long and loud. No one likes to face a dilemma, and this control dilemma is a particularly distasteful one for western liberal minds.

The *distribution dilemma* pits the unacceptable cost of sharing the earth's resources equally with the consequential cost of not sharing. The gap between the rich nations and the poor ones seems ever widening, and as yet, there is no suitable mechanism to redress this unstable trend. Planetary limitations constrain the range of solutions, for there is just not enough for all to live like middle-class North Americans. The mechanism for getting the advanced nations to reduce their standard of living so that their real wealth may be more equitably shared remains undiscovered.

The *job/roles dilemma* stems from our coupling of personal worth with a job. The legitimate social roles in an industrial society are largely limited to having a job, being married to someone who has a job, or being a student preparing for a job. Unfortunately, the significant achievement of our industrial technology has been the elimination of jobs. Industrial society proceeds to eliminate the single major source of roles legitimized by that society.

Leaving Harman, a fifth dilemma can be identified, the *affluence/scarcity dilemma*. The consumption ethic that underlies industrial society depends upon the widespread acceptance of the notion of scarcity. People are taught to believe that their possessions are never adequate and that additional possessions are always needed. Possessions are seen as being forever scarce. Such conditioning gives utility to the prodigious output of an industrial society. The task of preserving that widespread perception of scarcity is a major one. The whole advertising industry is dedicated to this task. Here, then, is a society that in spite of its bountiful output must continually convince its members that they exist in a perpetual state of scarcity! Slater (1970) delves into the repercussions of this dilemma.

These dilemmas have been referred to as the *problématique* of industrial society, and they all stem from the incredible success of the industrial system. The old saw "nothing succeeds like success" haunts us with its irony. Since further application of industrial technology can only make these dilemmas worse, they represent the saturation of that technology.

This saturation is what one would expect of a positive feedback relationship between the major elements of a system. The four-member, mutually reinforcing, positive feedback, socio-economic model developed above behaves in accordance with the observable facts.

Two hundred years ago, the economic limitations of the mercantile system were avoided by the successful application of a new technology. Today, information technology seems to face the same kind of opportunity. The practices we use in playing our present economic games seem to be approaching saturation. Perhaps the new technology will allow the development of new practices or games within which we might commonly perceive economic utility. In this sense, the

Chapter Three

THE HYPOTHESIS

In spite of an extensive literature on the subject, the innovation process is at best only dimly understood. Some innovations succeed to a surprising degree, while others fail and equally surprise the innovation's champions. In the area of communications innovations, CB radio succeeded beyond the wildest visions of those who planned the concept, while Picturephone was a surprising failure to the men behind that innovation. In such cases, hindsight is always clearer than a priori vision. Market analysis often gives an erroneous result, for frequently such studies tell the investigator only what he really wants to know. It is said that Xerox's studies showed a considable demand for a colour copier, but when the product appeared, the market was not there in the magnitude anticipated. There is no reliable, valid theory of innovation that consistently works in the real world.

The absence of a reliable theory of innovation does not diminish the importance of the process, but rather merely constrains the way innovation can be usefully discussed. By avoiding such questions as those that involve how successful innovations are selected, how they come to pass, and other epistemological issues, we can move to harder ground by dealing with innovations in terms of the impacts they have on particular socio-economic systems. Technological innovations can then be described under two classes, the intensive and the extensive class.

Intensive innovations
V.
substitution

The intensive class contains those innovations that interact with the socio-economic system to produce impacts that are principally direct or first-order impacts. This kind of innovation results in an intensification of already existing processes. Hence the class name, intensive. In general, this first class of interactions between technological innovation and socio-economic systems is related to cost reduction and is characteristically labour releasing. Substitution is a key strategy here, and an example would be the replacement of donkeys with steam engines to power mine-shaft hoists.

This is a very important class of innovation, and we have become very good at it, so good in fact that we have created the job/roles dilemma outlined in the previous chapter. In a very real sense, we may have become too skilled at creating this class of innovation.

Extensive innovations
V
transformat

The second class represents more of a transformational thing, as opposed to the extrapolative first class, and is exemplified by putting that same steam engine on wheels and having it run along tracks, pulling things. The cities created by the railroads were higher-order impacts of the interaction between steam technology and our socio-economic system of a hundred years ago.

This extensive class of innovations, where the higher-order impacts are more significant than the first order or direct ones, is characterized by the doing of new things in new ways, by labour absorption or job creation, by what amounts to wealth creation. The name stems from the fact that the impacts from this class of innovations are very extensive, spreading both across the society and throughout time, far beyond the immediate first order or direct impacts of the innovation.

In the early days of the Industrial Revolution, the British managed to keep both these classes of innovation in relative balance. In spite of a 50 per cent increase in population over a mere forty years, employment held up and inflation was not a continuing problem. Josiah Wedgewood's career illustrates this balance quite nicely.

Wedgewood was a very good industrial engineer, and many of the techniques he introduced to improve productivity in his Etruria factory are still in use, establishing his ability as a creator of innovations of the intensive class. He was also a superb researcher, for over ten thousand recorded experiments were performed to develop Jasper ware. In addition, he was a great marketing genius, pre-dating by far Henry Ford with his notions that quality goods produced at affordable prices and in significant quantity had important socio-economic significance. He used the sales of special tableware sets to various royal families to finance his development of the products for mass production. While his industrial engineering efforts were innovations of the intensive class, the research and marketing innovations were of the extensive class. Mass-produced, affordable tableware that could be properly cleansed had a significant impact on the health of the whole population. Clearly, there was a strong extensive component present in his work to accompany the intensive component. There was a nice balance.

THE HYPOTHESIS

A key hypothesis can be formulated: only the intensive, or first order impact, class of interactions between information technology and our socio-economic system is working; the extensive, higher-order-impact, more magical, and transformative class of interactions is somehow inhibited. Examination of the consequences of this hypothesis shows that the logical conclusions flowing from its acceptance match the observable facts to an alarming degree.

Intensive
info.
technolo ✓

Consider the proposals made for new communications services and note the presence of strong themes of replacement, substitution, and expense saving. Shopping from the home; telecommunication substitutes for travel; electronic funds transfer; pay television; word processing; electronic mail; all are members of the intensive class of interactions between a technology and a socio-economic system in that their principal impacts are the intensive, first order ones. Just new ways of doing old things rather than new ways of doing new things! ✓

The input-output economic model of the U.S. economy that Porat (1977) built as a result of his analysis of U.S. statistics for 1967 shows that an increase in the capitalization of the information sector, to the detriment of the remaining sectors, would produce a smaller GNP and an increase in unemployment. This is the result that would be expected if only the direct or first order impact class of technological/socio-economic interactions was functioning.

As we saw earlier, Porat also showed that over one-half of the labour force is engaged in the information sector of the U.S. economy. One hundred and sixty years ago, in Britain, the economic contribution of the industrial sector was quite obvious, with only one-third of the labour force deployed in that sector. Today in the information sector of our economy, we have a larger labour commitment and a less satisfactory economic situation. With so much of the labour force so deployed, either there are no significant extensive, higher-order impact class of interactions present in the relationship between information technology and society, and Yoneji Masuda is hopelessly wrong in his forecast of an economic revolution of the greatest significance stemming from this technology, or there is validity in the argument that some fundamental constraints are operating to inhibit the extensive class of interactions.

constraints
preventing
extensive
information
technology

If we accept the existence of constraints, is it possible to embark on some constructive action that might succeed in releasing some of the economic magic without knowing the specific nature of the constraints? Perhaps so, for knowing things are stuck is almost as good as knowing why they are stuck.

In the late sixteenth century, the key problem facing the sea-going traders of the day was that of determining longitude at sea. Lloyd Brown (1956) gives a fine account of how the problem was solved. After repeated attempts and with unstinted support, the scientists of the day just could not solve the problem. This was the time of many great men, Newton, Halley, Hooke, and Huygens, to name just a few. The solution lay outside the conventional wisdom that these men brought to the problem, and things had become stuck.

The log jam was breached when Parliament established a prize of £20,000 to be paid to the one who solved the problem. Hope of winning such a rich prize drove many creative minds to seriously attack the problem, providing a rich pluralistic approach that the conventional wisdom could not match. It was a carpenter, not a watch-maker or a scientist, that provided the much sought answer. Pluralism worked.

Pluralism led to the solution of the longitude problem, a solution that lay outside the ken of contemporary technology. This technique of actively encouraging pluralism is a very powerful one that might be useful in discovering how to move beyond the constraints that seem to be inhibiting the extensive interactions between information technology and our socio-economic system today.

If the hypothesis developed here has any validity, then we have a constraint on the development of demand pull in the supply-demand model of economic activity. This constraint does not stem from mere novelty, but seems more fundamental. The societal learning of the past four hundred years, described in the previous chapter, may well be what is blinding us to the particular opportunities offered by this new technology. Consider, for example, the content of information technology, that is, information itself and its role as an economic good. Compare this role with that of the content of industrial technology, hard goods. Is the difference real or is it some kind of learned response? The next chapter examines information as an economic good.

Chapter Four

INFORMATION AS AN ECONOMIC GOOD

In those areas where information markets do exist, where information products are traded for their own sake, we find that the supporting information technology is still largely shaped by ideas from the older age of industrial technology. Massive production and consumption of identical products for each consumer characterize the book industry, the record industry, and the television and film industries. The potentially important, new aspect of information technology has little to do with this mass production and consumption of identical goods concept. Although we still hear echoes of the past extolling the wonders of unlimited bandwidth transmission from satellites or optic fibres, the really important technological development is the availability of cheap processing and storage, permitting the evolution of intelligent terminals and intelligent networks, and not simply larger and larger pipes. It is not quantity that counts, it is quality. More and more, bandwidth is just a hangover from the bigger-is-better notion spawned by industrial technology.

Unfortunately, the full significance of this important differentiation has not been widely perceived. As a result, the potential of services, where the output delivered to the user is personalized and tailored to suit his own particular characteristics and needs, is ignored, and the attention is directed towards those information activities that either support or mimic activities of the industrial technology era. Masuda's idea of computers producing information for direct consumption in a market-place is completely overlooked. Consequently, the whole basis for the economic revolution he predicts is invisible. Perhaps the greatest danger that this state of affairs brings is policy decisions that inhibit, rather than encourage, the evolution of Masuda's vision.

Information frequently fits the "public good" classification of conventional economics, where the marginal cost of adding another consumer, even if he is a "freebie," is zero; and such a consumer does not reduce the quantity available to the other users. Once produced, public goods have a marginal cost equal to zero. Once a television programme is produced and aired, it costs nothing to add another viewer, nor does that viewer rival those already viewing in any way. The efficient price, according to microeconomic theory, for goods or services with zero marginal cost is zero. However, such a price will provide no stimulation for further production of the goods. Hence, goods and services that have the public-good attribute are generally underproduced unless there is collective intervention of some sort. In a system of private markets, it is impossible to optimally supply a good where production and allocation prices differ markedly, for the good will be either over or underproduced, depending upon the particular inequality. The public-good attribute of information is particularly evident in those cases where information technology has been strongly influenced by the old industrial paradigms.

The public-good aspect of information tends to be accepted uncritically in the literature. If the particular way the technological support for information activities is structured tends to emphasize the public good attribute of information and this aspect is accepted uncritically, the pressure to move towards non-market allocation techniques may result in technological opportunities being ignored, that could produce other more beneficial results.

In the economic sense, the public or private state of a good is usually thought to be a property of the good itself. Information technology has a surprise for us. Two information-retrieval systems for the home market can be described that would at first glance appear to differ only in technical details. They can contain exactly the same content, but the content in one case acts as a public good and in the other, a private good! Both these systems exist today as market trials in Great Britain.

The first system is Teletext, a broadcast-type system that transmits its entire library sequentially, piggybacked onto regular television services broadcast either over the air or along a CATV cable. The desired parcels of information are snatched up by the Teletext receiver and displayed on the screen of the user's television. The underlying network structure is that of a one-way broadcasting service. The name Teletext is a generic term for the class of systems of which the British Broadcasting System's Ceefax was a prototype.

The alternative, Videotex, delivers the requested information via the switched telephone network to the Videotex receiver, where the data are formatted for display on the user's television screen. Here the underlying network is the complex, mesh-like one of the telephone. Again, the name is a generic term, and in this instance, the British Post Office's Prestel, or originally Viewdata, is the prototypical example.

In theory, the content for these two systems could be identical. The user's control boxes could be similar. The organization of the information in the systems could be identical, hierarchical, and menu ordered, for example. The billing in the Videotex case would be simple, immediate, and accurate, for it would be done in a manner resembling that employed for the calculation of long-distance telephone calls. Who accessed what and therefore owes how much is easily determined in the Videotex-type system.

The Teletext-type system has problems with billing, precisely because it has forced the content into being a public good. By presenting the entire library as a giant "information smorgasbord," Teletext has neither control nor record of who chose what from that smorgasbord. The only way billing can be accomplished, beyond some flat-rate formula, is for the user's equipment to be also the record keeper. Periodically, the user's records would be collected and a bill prepared. A number of schemes have been proposed for accomplishing this, each adding cost, an externality imposed by trying to operate a market in a public good. Since the user deletes nothing from the information smorgasbord while snatching the piece of information he wants, additional users present zero marginal load on the system. Only by some kind of complex arrangement could pirates be prohibited from receiving the service and reselling it, for they have access to everything. The information content in such a system is clearly behaving as a classical public good, and so no significant market could be built without encountering major difficulties which are well described in the literature.

Content in the Videotex-type system behaves totally like a classical private good. Since all users enter the system via an interface with a computer, it is an easy matter to deny service to non-eligible users. Furthermore, adding additional users entails enlarging the user interface facilities of the computers used in the system, and so marginal users rival bona fide users for service. Since the properties of exclusivity and rivalry are present, the system offers its content as a private good, not as a public one. Theoretically, this opens the way for the establishment of a proper market.

The emergence of personalized material as the significant content further illustrates the fundamental difference between the Teletext- and Videotex-type information-distribution systems. Idiosyncratic material would be controlled by algorithms or "recipes" created by the authors, recipes that would control the interaction between suitable data bases and the particular user's responses to produce the personalized output. These recipes are always completely hidden in the Videotex-type system, but would be "loaned out" to the user for processing in his terminal unit in the Teletext case. The authors' rights are inherently less exposed to violation by nature of the structure of the Videotex system and its properties of exclusivity.

When a good, behaving as a public good, is traded in an open market, additional costs generated by each transaction are never covered in the exchanges associated with that transaction. These costs are referred to as externalities, for they must be dealt with outside the immediate theatre of transactions. An example of an externality from the non-information field would be the cost of maintaining an acceptable physical environment, one that is relatively free from pollutants, and so on. The cost of operating a performing-rights accounting system that charges radio and television stations for the use of music, and then compensates the authors and composers on a *pro rata* basis is an example of an externality from the information field. This latter example is caused precisely because the output from radio and television stations does behave as a public good, and complete restitution can only occur with externally completed transactions. Trying to operate in a market or trading way with information that is acting as a public good always generates the need for a precise and well-defined system to protect the author's rights, and the cost of doing this is an externality. This cost would not be incurred if the information behaved as a proper private good.

Markets never run for free. There is always a cost. Here, in the example of Teletext and Videotex, we have the cheap technological solution of Teletext that creates externalities, and the rather more expensive Videotex-type system that does not need to generate the externalities at all if the billing is done properly. The question becomes whether to invest in a cheaper system and suffer the continuing externalities, or to invest somewhat more in the first place and avoid them. Clearly, a properly used Videotex-type system, with its higher technology costs, is a better long-term investment because of the avoidance of the continuing externalities, if one views the situation over a reasonable time and impact range.

Beyond this "cost of operating a market" argument lies the cost to the society of underencouraging its potential contributors, of underproducing quality content, and so of limiting the value of the whole enterprise because of the arbitrary decisions that operation of a public goods market always involves, as outlined earlier. Because we have no real idea of the potential magnitude of this cost, we had best be careful, for it could be the significant item in the equation. This could be where the real wealth creation is buried in the information society.

In overly simplistic terms, the kind of network that supports our cable-television services, if used in the obvious way, would produce a system of the Teletext class that would force its content to behave as a public good, hence missing the greater potential. On the other hand, the common telephone network superbly suits the Videotex class of systems, and offers all the potential of a proper private goods market-place. In truth, neither network, as it now stands, is adequate.

Information technology's greatest potential is an ever improving, mesh-like network linking us together in rich, complex, and supportive ways. The socio-economic consequences of choosing to develop the new information services on an inadequate network structure could virtually eliminate the opportunity to establish a meaningful, wealth-creating information society smoothly evolved from our present state.

We really never have had a supportive environment casting information as a truly private good that was robust and extensive enough to support a significant market activity. Therefore, in the early stages, there may be little difference between jurisdictions that choose the more complex network structures of Videotex for information services over the simplistic broadcast structures like Teletext, for the requisite market experience does not exist. The content for a proper information market has yet to evolve, particularly that which utilizes the personalized capacity of the more complex network structure. However, it is the potential of the richer private good strategy that is important.

Once upon a time, it is said, the citizens of Sparta chose to retain iron bars as their legal medium of exchange, while the rest of Greece went to the new technology of coinage. To the Spartans, iron bars, for which utility obviously existed, were more representative of wealth than were mere tokens.

The physiocrats of two hundred years ago held that only in agriculture did productive effort produce a surplus over cost. Neither manufacturing nor trade yielded any such surplus in their view. It was the agricultural economic surplus that sustained all other activities. All the gain in the system, to use contemporary terms, was in the agricultural sector, and all other sectors were lousy subsystems. Wealth creation, in the absolute sense, was the sole prerogative of husbandry. Such was the view of the physiocrats of France in the late eighteenth century.

We still have the descendants of those Spartan economists with us today, and Galbraith (1977) recognizes the echoes from the physiocrats in the contemporary politicians' plea for the farm vote. The stoic economists' and the physiocrat philosophers' contemporary descendants have concerns that are just as real and limiting as they were in those earlier days.

It is important to recognize that the "basic truths" of economics change throughout time. The real sources of wealth are precisely those activities that we perceive as being worthwhile, particularly where some labour gain can be incorporated. Were it otherwise, we would organize to change things. Zipf (1965) hypothesizes that evolution favours not the survival of the fittest, a Spencerian development of Darwin's ideas, but rather those who expend the least effort in arranging for their necessities, hence freeing effort for breeding and other more enjoyable pastimes. In true Zipfian fashion, we have reduced agriculture to a level requiring about 3 per cent of the North American labour force. What the remaining 97 per cent do relates to things more frivolous than staving off the Malthusian threat. As a society, by and large we do the things that we perceive as useful and enjoyable.

We have moved from the physiocrat's narrow economic view of wealth creation being confined to husbandry, and now identify it with the total of goods and services produced in the society. Automobile production has become a popular measure of our economic health. Gloomy forecasts from merchants in November send tremors of fear throughout the society. Our perceptions of the source of wealth relate to the manufacture and exchange of hard goods, the extraction of the earth's natural resources, and husbandry. A good wheat crop, an increase in auto production, happy merchants at Christmas, and cheap energy supplies provide the basis for most people's view of economic prosperity. How well we have learned the lessons from the last four hundred years of intensive trading of physical exchangeables! Only philosophers and other economically irrelevant souls argue that the environment, our arts, and other non-GNP items also contribute to our wealth.

The important question is can we perceive economic utility or wealth creation flowing from the mere exchange of such an ethereal good as information? If we, as a society, find such exchanges useful and enjoyable, we should. We bring with us the perceptual baggage collected over the past four centuries that would tend to conceal the potential benefits of such exchanges. If, however, we all accept that such exchanges can have utility, and agree on how utility from such exchanges can be transferred over to our existing exchange systems, and vice versa, then we will have gone a long ways towards solving our economic problems.

The Spartan economists have died out. True physiocrats are rare. Let us hope that those that limit their perception of economic utility to the exchanging of hard goods, while denying any utility to the exchange of ethereal goods, will also die off. Let us also hope that they are accompanied by those who would use the new technology as if it were more of the old, so compounding the problems we now have, rather than moving on to newer and hopefully more tractable ones. Otherwise, the hope of expanding our economic activities at a sufficient rate as to ameliorate our current economic problems is virtually non-existent. In spite of the theoretical and practical difficulties, ethereal exchanges must grow in utility and quantity unless some other certainly less acceptable options are chosen.

So very little imagination has been evidenced in discussions on the economic aspects of information that one must accept as completely valid the thesis that four hundred years of cohabitation of the four members of our socio-economic model have thoroughly constrained our perceptions of the wider economic aspects of information.

In a sense, this difficulty constitutes an economic constraint acting to inhibit the exciting extensive class of information technology innovations outlined in the previous chapter. This economic constraint on the demand pull is really of our own creation and should therefore be amenable to shifting or elimination.

Chapter Five

THE INFORMATION MARKET-PLACE

A brief review of the argument to this point will help reinforce the context for what follows.

Successful industrial economies the world over are experiencing deeply rooted problems, problems that in the limit are not solvable with further intensifications of industrial technology. The structural shift in these economies towards an information base and the emergence of information technology have not been accompanied by anything like the socio-economic benefits that the introduction of industrial technology brought two hundred years ago. Information technology, although it has provided many socio-economic benefits, has failed to produce the socio-economic breakthroughs that might be expected of it, given its apparent theoretical potential. Unlike its industrial antecedent, information technology has not produced a period of rising real wages in the presence of rising costs. Furthermore, this technology may be tending to exacerbate existing economic problems. Many of our present utilizations of information technology have a significant toxic aspect, and further intensification of established usage patterns will likely produce undesirable results.

Innovative applications of information technology that have significant higher order impacts and are wealth creating, transformative, and socially beneficial seem to be constrained from occurring. Our centuries-old experience with the trade of hard goods, our dedication to industrial technology, and our poor understanding of wealth creation seem to be amongst the constraints. The information market-place concept is advanced as a strategy that seeks a pluralistic approach to the constraints that might be operating along with the economic one outlined previously.

So long as information activities were at a low level in the economic scheme of things, no difficulty was created by these activities serving as aids or supports to other more economically productive activities. However, the servant has grown to become the dominant figure. Information-sector activities in the United States now exceed the other sectors. The wages being paid in this sector are not unattractive, and it is unlikely that the imbalance created by this wage pull will be satisfied without an even greater population of information workers, to the further detriment of the other sectors. With our present economic structuring, this dominant and apparently still-expanding body of labour finds its significant economic validation through the conventional economic sectors. Surely the exploitation of these older markets by this sophisticated labour group, skilled in the use of information and desperately seeking socio-economic validation, can only exacerbate the *problématique*. That the dominant labour sector of an economy has no major, direct market-place can only be an anomaly.

THE INFORMATION MARKET-PLACE

An information market-place ideally should allow anyone to offer ethereal goods, or information, for sale. The fact that information is a somewhat recalcitrant economic good means that a complex and intelligent market-place will be required. This is precisely the kind of problem information technology can address through intelligent terminals and intelligent networks. The simplistic view that any universally available information-retrieval system would solve the problem is just that, simplistic. For a market-place to function efficiently, it must deal in goods that behave principally as private goods. In chapter two, we noted that the particular distribution mechanism supporting the information market-place must be wisely chosen, for cost-attractive systems exist that will not allow their information content to behave as a private good, and so lead inexorably to the underproduction of adequate content and other unabsorbed externalities that can defeat the potential value of the effort.

Attention may be an information-related commodity that is sufficiently rare as to warrant allocation via a market. If so, then an information market-place should accommodate both modes of operation, one where it is attention that is being traded, and the other, information. It is unlikely that there is any significant middle ground, for indifference is certainly not a rare resource, and clearly no technological aids to the production of indifference are required.

The reward given to the successful contributors to an information market-place can be viewed as a form of attention. Certainly, authorship rewards are likely to be rather scarce and require careful allocation. This approach would reward most that author who succeeds in providing the material that is used the most. Perfectly conventional, so far. Consumers would be charged a flat rate for unlimited access to this sector of the system, for their attention is used as the good that is exchanged, with the authors competing for that attention. This treatment would generate the most revenue for the more popular contributors. Less popular and more specialized contributors would be found in the "pay for what you get" section of the system. Here, the cost per page will be considerably higher than in the other section. This presents the contributor with the decision to place his material in the low-price, heavy-use category or in the high-price, low-use one. Storage charges for content would be adjusted to maintain a reasonable balance, it being likley that the charges for the high-price, low-use sector would be quite low with respect to the storage charges in the other sector.

In the low-price, heavy-use sector, the total revenue available to all the sector's contributors is fixed, for it is the total of the flat rate fees collected from all users. In the other sector, the pot size is a function of the user activity. In the first sector, the contributor's objective is to win revenue away from other contributors, while in the second sector, the objective is to win revenue from the individual users. The resulting content will likely be quite different in the two sectors. Most of the material suggested today for inclusion in information service systems is of the class and kind that would be found in the low-price, high-use sector, where authors are pitted against authors. However, as time goes by, the interesting and economically significant material is likely to emerge in the high-price, low-use sector, the sector for which there is really no adequate existing precedent. This sector can develop only if the electronic delivery system supports its content as a private good.

Since a market-place requires information about the products that are being traded, there is a requirement for information about information. This information about information can never be "perfect" in the economist's sense, for if it were, there would be no requirement for the end-product. Information about information will have some of the aspects of advertising. Since it must protect the information being offered, and yet generate demand, great skill will be required. It must match both the consumer and the product, and hence may be just as varied and user specific as the information itself.

The entrepreneur who can develop cataloguing information about a chemical data base, for example, in terms that electrical engineers can manage, stands to benefit from its use as does the purveyor of the more specific original data base. This role resembles, in some ways, the role of broker or retailer in conventional trading relationships. The demand for specific information services can be increased through the activities of entrepreneurs whose objective is to broaden the recognition of the utility of that specific service. Therefore, there is an opportunity for entrepreneurial activities in the preparation of this information about information. As the material in an information market-place becomes bountiful, adequate information about information, and even on to higher iterations, results in an easing of the problem of locating useful services for the average user.

General Motors "appoints" dealers to supply information about their new cars and otherwise assist potential customers in coming to the "correct" decision. This structure can be maintained so long as General Motors restricts the set of customers with which it will deal directly. In an information market-place, "General Information Corp." would not so restrict its trading. The information market-place would feature an automatic accounting facility that makes the handling of a multitude of minuscule transactions as easy as the handling of a single large transaction. This removes the necessity of hierarchial distribution networks. The accounting problems of having individuals deal directly with General Motors makes the hierarchial infrastructure essential in the mass production world of industrial technology. Information technology is not so constrained. The telephone company can make money from many twenty-five-cent long distance calls. General Motors needs a dealer network to shield it from a vast volume of trivial transactions; it could not afford to sell replacement tail lamps directly. Nor could we afford to buy them that way. General Information Corp. would deal directly with its end customers through the computer-based record-keeping facility of the information market-place.

Independent entrepreneurs, having a full acquaintance with General Information Corp.'s products, would offer proprietary indexing and search routines better suited to the unique needs of particular customer groups. If such an entrepreneur did a better job than General Information in terms of matching the product descriptions and indexing structures to the needs of particular users, then that entrepreneur could expect to earn a revenue from the use of his service. His activity would generate revenue for him and additional business for General Information. Furthermore, he could offer indexing and search routines that combined General Information products with those of other suppliers, again to the benefit of all concerned.

The brain is infinitely more complex than the stomach. It is relatively easy to assemble a list of things that have broadly perceived high utility for serving the needs of the relatively simple stomach. Individual tastes are easily accounted for through the inclusion of a minor degree of choice in the menu offered at a restaurent, for example. Only when the choice is very restricted can even this relatively simple serving of human needs be organized on a national or international basis. Taste for brain food is far more individualistic than taste for stomach food. The utility for information will be far more individual than the utility for particular foods ever was. A given information package will appeal to only a few individuals, and many, many such packages must be prepared to give a collection of information any utility to a user population. No simple menu will suffice. McDonald's "Infoburger" is already available on our news-stands. No new technology is needed for this market.

The intellect, being infinitely more discerning than mere belly pains, will require a rich fare indeed, even individually tailored, if information is to be the new good that is sold in a technologically sophisticated information market-place that serves needs beyond those now served by news-stands and conventional libraries. This rich demand characteristic and the resulting rich supply situation will lead to the emergence of information brokers. Furthermore, this richness can only be satisfied through a wide diversity of sources for the material offered in the market-place.

Authorship will likely evolve into an activity that is widely diffused throughout the population. General Information would inhabit the high-usage, low-price sector of the split system described above, while the richer, more complex fare would develop in the other sector. General Information is really a myth, except perhaps as an aid to getting the market established.

The creation of information is quite different from the creation of automobiles. Composers do not work in large organizations. Today, most composers are entrepreneurs in their own right. Similarly, tomorrow's significant contributors to the information market-place will be independent entrepreneurs.

All of the above describes an information market-place where information is the good that is exchanged. Needless to say, the technological environment required to support such a market would also support the kind of information needed to ease the operation of the markets with which we are more accustomed. Economists claim that markets run best with "perfect information." Clearly, such information would make fine content for the information market-place. This class of content is likely to be very important, Already, the want ad is recognized as being an important part of the content of the British Prestel system.

The pluralism that is inherent in the information market-place is an important key to overcoming the little-understood constraints that appear to be inhibiting the application of this new technology in both socially and economically beneficial ways of major significance. The challenge is to develop the infrastructures required to make an information market-place develop and truly prosper.

Chapter Six

ELECTRONIC MEDIA AND THE INFORMATION MARKET-PLACE

If an information market-place is something that we should strive to create, what kind of information technology or electronic medium might be used to that end? Can our existing television system be of significant use, could it be extended, or are we facing an opportunity and a need to create an entirely new electronic mass medium? To answer these questions, it is necessary to examine television as honestly and critically as we can.

TELEVISION

Television is a truly great medium. In spite of the comments about the poor quality of its content, it does make material widely available that would otherwise be far too expensive to produce. In its better moments, television is an outstanding achievement. Its content is really incredibly good, given the constraints the medium faces. No prince of yesteryear had so much fine entertainment at his beck and call. Television makes the best available to even the poorest citizen. Television has achieved this through a process of very intensive development.

In a few short decades, television has penetrated nearly every home in the advanced countries of the world. It is the intensity of our embrace of this medium that raises concerns about its ability to form the technological basis for a really significant information market-place.

Television and society

Television, as a medium rather than as a mere technology, has trained its viewers to expect a very high level of technical quality in entertainment. "Acceptable" television content is very expensive to prepare. It is not possible for the average citizen to create material that has any chance of being considered "quality" material. The inputting of the medium must be done by properly trained and generally well-funded professionals. In this sense, television is not a convivial medium, for it is unavailable to ordinary people as a means of propagating their ideas and feelings.

There seems to be a relationship between the production cost of television content and its eventual popularity. The more expensive a programme is, the more likely it will reach a large audience. In mathematical terms, the relationship between production costs and audience size is essentially a linear one. This law seems to override the desire for locally originated material, for the higher budget, mass-market material wins out over the low budget, local material on the average. This unfortunate relationship between production costs and appeal has led to the development of a concentrated-source type of infrastructure, with a few production centres providing the bulk of the material. Given the cultural learning that has already occurred, it is unlikely that this situation can be altered. The medium, in terms of the production aspects, is heavily dedicated to concepts of centralization.

The printing press was the prototypical mass production machine. We must not be confused by the content of the printing press or television and think of these media as being archetypical examples of information systems. They adhere to the basic industrial form. A factory mass produces goods through the use of capital-intensive machinery. The printing press mass produces printed matter.

Television is a little more subtle, but nevertheless still an industrial form, in one strong sense. Television mass produces attention through the use of capital-intensive content. The more capital invested in a factory's machinery, the more goods one gets. Similarly, the more capital invested in television content, the more attention one gets. In both cases, the output, whether goods or attention, is sold to provide revenue. The analogy is more than superficial. Television is a capital-intensive process for the mass production of attention that is then marketed like any other commodity.

Clearly such a medium cannot readily be the basis of what might be described as a convivial "cottage information industry." Viewers' tastes have been developed to such levels of sophistication by this very intense process that amateurish, although perhaps more honest, content would be virtually ignored in the presence of content designed solely to win attention. No massive shift in the form of this medium can be expected.

Conventional pay television would likely offer the means to further extend the linear relationship between production cost and appeal by removing the constraint now placed on that relationship by the finite advertising budgets of the sponsors. The hope that an ordinary citizen might make a movie that would earn even a modest royalty through exposure on a conventional pay-television system has to be nothing but a pipe dream.

There are two ways in which television could be extended that might be worth examining. However, both these strategies could produce even further intensification of the television medium as we now know it if handled in the wrong way. The first involves the addition of instantaneous, mass-audience response facilities, and the second consists of a very much modified retrieval or "demand pay-television" system. Both operate in conjunction with the presently understood mass television medium, the former being a modifier and the latter a co-existing alternative.

Numerous experiments with systems that allow the polling of television viewers' responses have been performed. Generally, these have involved the viewer placing a telephone call to record his response to a question posed over a television broadcast. Even when a computer has been used to accept the calls and record the viewers' responses, the number of respondents that could be handled simultaneously has always been a trivially small number, resulting in many people being turned away, receiving only a busy signal while attempting to get their views recorded. Consequently, the accuracy of audience opinion as determined by such systems is questionable. The telephone system has run into some problems with the high levels of traffic generated by such experiments, indicating that many more people were turned away than actually got to record their views.

A number of years ago, a system was designed to remove this traffic so that it did not appear at the switching centres. The fear was that, without suitable precautions, serious interruptions to regular telephone service could result from intensive use of telephone-switching equipment for polling traffic. A great volume of very short calls all heading for the same destination causes other telephone service users to be denied service. To deny the ability to summon the fire department because a television programme has requested its viewers to call in with their responses to a question would be unconscionable. The system designed by Bell Northern Research stripped the special signals associated with the polling service off the telephone lines before they got to the switching equipment, making it possible to process millions of responses in mere seconds without delaying or interfering with a single telephone call. Incasting, as this system was called, would allow the coach of a football team to poll the home audience during the game, and in just a few seconds, determine if he should attempt to win the first down or kick the ball, all within the time of a normal huddle.

The responses of the individual viewers are anonymous in this system, although a certain percentage of viewers, with their permission, can be tagged and calibrated, so that statistically inferable results can be produced. This anonymity is vital. It means that "instant referenda" are denied. A referendum taken in haste and without suitable allowance for deliberation is a dangerous thing. Besides limiting the political impacts to being essentially benign, this anonymity prevents connections between the television response system and systems that could be used to culminate sales and purchases. Response systems that responsibly record the viewer's identity could usher in mass selling practices of frightening proportions. Even "instant loto": three national lotteries in a half-hour television programme, each with its entire sales campaign, winner determination, and with all transactions being automatically recorded by an associated electronic funds transfer system, could become very popular and commonplace television fare. If this were done for "good causes," what defence would a society have? The anonymity feature of the incasting approach limits both the political and socio-economic impacts to being relatively benign. It also allows it to process millions of responses in mere seconds. It is a system that thrives on very intense but brief "spikes" of traffic.

Demand television is achieved when one can request something and have it delivered to his television set. Such systems can take several forms, most of which have been demonstrated at various times in various places. The simplest is conventional pay television. Here each requester is shown only what he orders, and anyone who does not order something is shown nothing. The material that is shown is scheduled. Choice is restricted to those items chosen for inclusion on the schedule. The systems used in hotels for showing movies are a representative example.

Other systems have been proposed that would allow a viewer to request anything, at anytime, from an extensive library, and he alone would be shown that material. This service is very costly. Traffic studies on such systems have demonstrated that almost every showing would be viewed by only one customer at a time. Consequently, each active user would tie up one entire video player or other programme source. Even with the correlating aspects of a school curriculum, the Ottawa television experiment, where over one hundred class-rooms were linked into an extensive television library, was only able to group several class-rooms for a single showing less than ten times in over a year's operation. Although we each would like to have our own material shown when we want it, such a service is prohibitively expensive.

A modification of this approach has been explored by a number of cable systems in the Province of Quebec. Here material that is requested is shown on several special channels, and once the material is put on, all subscribers can view it. Although the cable operator does not make a specific charge in this instance, a revenue-producing formula must be put in place if the service is to be part of our information market-place idea.

In applying a tariffing structure to this kind of system, it seems reasonable to differentiate between those viewers who wish to exercise choice and those who choose to "go along" with what has been chosen by others. The idea of restricting chosen material to only those who have chosen it is what makes the one-on-one demand system so expensive. And so the following system idea emerges.

The television cable would carry two groups of channels. The first group would be the conventional cable television signals, while the second group would be special programmes available to subscribers who choose to pay an additional flat-rate fee. One of these channels might carry the schedule information for the remaining special channels, detailing the times and the material that would be shown on the other channels in the group. Requests for specific material would involve an additional charge depending upon the particular material chosen and the time chosen for display. The cost of a fetch would be negotiated, for a viewer could choose to see his material at an early morning hour, when the system would be virtually unused, or he might choose to compete for space during the more heavily loaded hours, when the fetch charge would be considerably higher. The person requesting would not bear the full cost of showing a particular piece of material, for a portion of everyone's flat-rate fee would cover the basic content and equipment costs. The specific fetch fee is free to be used as a means of regulating the load on the system, rising as the load rises, and falling as the load falls. This system is described more fully in Thompson (1977).

If the requisite technology were to become available, the payments to the producers and creators of the content material could be adjusted to reflect the actual number of viewers rather than just the number of fetches. This sensitivity is just what the information market-place concept is all about. Such a sensitive demand pay-television system would be a fine vehicle for the "low-cost, high-usage" sector described earlier. This is a vastly different system than one that merely exhibits the outpourings of the major film studios.

In the LaMarsh report, Thompson (1977) calls this a "diffuse benefit" system, for the system has been structured to produce revenue streams that diffuse throughout a wide group of content contributors. It is the diffuseness of the revenue structure that is important. To further intensify our use of television without attempting to generate revenue streams that can diffuse throughout the user population would be an act to deny the potential of an information society.

Television is likely to remain a very robust means for the mass production of attention, unless intervention occurs to move it in the directions outlined above, and that intervention must be done with extreme care if even further intensification is to be avoided. In a modern industrial society, it is extremely unlikely that television, on its own, will become anything else.

Television and the individual

Today's television images are both ethereal and ephemeral. They blow away and cannot be brought back on demand. The extent of the social toxicity stemming from this aspect of television is just unknown.

Symbolic interactionists hold that an individual is formed by being a member of a communicating society. Communication is through the use of symbols, the interpretation of which is the chief learning that an individual does in his early years. These symbols range from the formal ones of conventional language through the highly informal ones of visual clues. Clearly the medium through which the individual learns these symbols is significant in influencing the development of that individual.

memory

Where the culture surrounding an individual is presented in an ephemeral or non-recallable way, individual memory becomes the critical element in the survival of the culture. Repetition and other techniques must be employed to aid in preserving the collective memory. Individual behaviour is essentially a non-critical response to the closest similar situation already stored in the individual's memory. There is just not enough psychic energy to permit significant analytical criticism of one's behaviour on an a priori basis. Havelock (1963) provides a fine description of the state of pre-literate man, whose culture was presented orally. He observes that pre-literate man's acts were responses to his situation and were governed by remembered examples of acts by previous strong men.

With the advent of writing or other recallable media as the basis for the transmission of culture, there evolves the opportunity for the emergence of a "me" that can interact with the "I" that is the result of these remembered and now recallable situations, and so allows behaviour of a considered nature to emerge.

It is Havelock's thesis that it was this transformation that really forms the basis of Plato's *Republic*. In effect, Plato was reporting on the impacts that wide acceptance of the phonetic alphabet had on early Greece. Havelock characterizes the culture before and after the transition, and uses the *Republic* as the data source to corroborate his hypotheses. In advancing a logical basis for Plato's avid condemnation of the poetic style, when the entire work is presented in what amounts to a poetic style, Havelock makes a stunning point, such inconsistencies being what is to be expected in a period of transition.

> The refreshment of memory through written signs enabled a reader to dispense with most of that emotional identification by which alone the acoustic record was sure of recall. This could release psychic energy, for review and rearrangement of what had now been written down, and of what could be seen as an object not just heard and felt.
>
> So it is that the long sleep of man is interrupted and his self-consciousness, separating itself from the lazy play of endless saga-series of events, begins to think and to be thought of, 'itself of itself', and as it thinks and is thought, man in his new inner isolation confronts the phenomenon of his own autonomous personality and accepts it.

Havelock suggests the separation of the "I" and the "me" as a result of the wide acceptance of the writing. In symbolic interaction jargon, Havelock would characterize man with the phonetic alphabet as having an "I-me" split, and man without it as being simply "I."

Whether the storage means be writing in a phonetic alphabet or some other technology, the significant thing is easy access to the stored material, not simply the form of that access. As long as there is very wide use of stored material, then the culture can be deemed to be transmitted from that storage medium as opposed to being transmitted by some ephemeral means. Therefore, the "I-me" man is one whose culture comes to him in large part from a stable storage medium, and the "I" alone man is one who has gleaned his culture primarily from ephemeral experiences.

Today, with so much of the population accessing their culture through the ephemeral images of television, we have again the ancient Greek oral man with us in great numbers. Gone are the days when a kid would spend hours poring over books, even sneaking a candle into his bed to extend his periods of access, as Lincoln is reported to have done. Television is perhaps the most significant purveyor of culture to a large portion of today's children. Will they have a meaningful "me" that can interact critically with the "I" that has been programmed in via the ephemeral medium?

Recognizing the present popularity of ephemeral television, it is perhaps time that we swung back towards the "I-me" man whose culture is easily available in recallable form to offset the media toxicity of television and the strong resurgence of the monolithic "I."

There is a profound need to limit the impact of this overly powerful and totally seductive ephemeral medium if it does restrict the "I-me" interaction that began with the phonetic alphabet adoption and grew into the complex society of recent years. The return to the non-critical behaviour patterns of pre-literate man in any significant statistical quantity could spell disaster for society. Such a potential exists, if it has not already happened.

If its extensions are chosen with appropriate care, television can play a significant role in the information market-place. Because these particular extensions would involve the addition of storage means to the television medium, they would tend to ameliorate the social toxicity now associated with television. However, television's contribution seems limited to the low-price, high-usage sector of the information market-place. More recent advances in information technology are needed to address the other sector of that market-place.

A NEW MASS MEDIUM

The information market-place is an opportunity to develop a new mass medium, one that is even now trying to be born, but in a disconnected fashion. The key to releasing the full socio-economic potential of the new information technology, with its communications facilities, computers, and intelligent terminals, and the like, lies in designing a suitable infrastructure wherein the technology encourages the content suppliers and users to interact in a synergistic way. Such an infrastructure could produce a new mass medium.

For a medium to become widespread enough to win the name mass medium, the potential users must have sufficient time available to use the medium. It is not inappropriate to suggest that a new electronic medium might look to television viewing time as the likely source of the time users would spend on the new system. If it is desirable to contain the media toxicity of television, then this new medium should be designed to compete with television for viewers' time. If it is to be a counterfoil to television, then it can be no mere extension to television.

Although this new medium could use aspects of television technology, particularly in the beginning, it must be separate enough so as to not confuse the user. It is not television.

- Instead of being ephemeral, it will be easily recallable.
- Instead of being paced by the producer or some other pundit, it will be paced by the user.
- Instead of delivering material chosen for appeal to the widest audience, it will offer tailored material, specifically aimed at small-user populations.
- Instead of offering literal visuals, as a camera does, it will feature more schematic or symbolic visual forms. Not fuzzy and indistinct, but crisp and sharp. Coloured, yes, but limited in shading capacity perhaps. Rather like the Sunday comics, but with limited motion capabilities.
- Instead of encouraging supine viewing, this new medium will elicit alert interaction.

Early confusion with television, in order to defray costs, could jeopardize the whole medium.

Illich's concept of conviviality is important in any such new mass medium. The infinitely variable and literal visuals of television clearly show the effect of costly sets, professional actors, cameramen, and other expensive production necessities. The visuals that are compatible with the computer are likely to be far more convivial in that they can be produced with only a modicum of training, and further sophistication in their preparation is just not perceived due to the limitations of the medium. Just as the telephone, because of its simplistic audio system with all its distortion and other transmission errors, does not require professional talkers, as do radio and television, so this simpler graphical form will be both accessible and useable by ordinary folk.

The British Post Office's Prestel system has many of the properties identified above, but is also lacking in some key areas. The graphics capability of the system, while reasonable in terms of the technological achievements of a few years ago, will seem quite inadequate in but a few short years. This shortcoming becomes all the more significant if one peeks into the future, where graphical capabilities are seen to likely increase in importance. Viewdata's simplistic approach to graphical material could be a serious constraint on future opportunities. There is no provision for motion, even on a limited basis, for example. Perhaps what is required is a "Prestel-plus" system. Later, as the potential impacts of a new medium are examined, some of the specifics of the "plus" will emerge.

Chapter Seven

THE LINGUISTIC CONSTRAINT

In the early days of the computer, there were many well-informed experts who predicted computers would do many marvellous things. Machine language translation, universal information-retrieval systems, and other linguistically oriented boons to society were commonly touted as being just around the corner. One man stands out because of his critical scepticism, Yehoshua Bar-Hillel. Bar-Hillel (1964) recognized the impossibility of machines being able to understand language. The problem relates to the context dependency of meaning and the idiosyncratic essence of context. In one paper he asks, "If we can't teach a Dolphin to 'understand', how can we expect to teach a machine to do so?"

Bar-Hillel was not just a pessimist, for although he developed arguments substantiating the impossibility of building machines that process language in a meaningful way, he went on to state that we could not afford to cease trying. Following ancient Hebrew tradition, perhaps, he claimed our efforts were damned, but salvation just might be possible. For this reason, we have named this linguistic constraint, which is as yet only dimly perceived, Bar-Hillel's conundrum. Before machines can produce information automatically, and recall that Yoneji Masuda proposed this as the underlying process for the productivity gain in an information society, this conundrum will have to be much better understood.

This linguistic constraint could turn out to be quite intractable, and require a fundamental paradigm shift before solutions can be found. It is rather unlikely that a head-on, massive attack will yield solutions of significance, given our current understanding of the philosophy of science as outlined by Thomas Kuhn (1962), for example. With our present understandings of, and techniques for dealing with, information, more pluralistic solutions, reminiscent of those used to solve the longitude problem and incorporated into the information market-place strategy, are needed.

THE SERENDIPITY MACHINE

> *ser'-en-dip'-i-ty: The faculty of happening upon fortunate discoveries when not in search of them.*
>
> *Funk and Wagnalls Standard College Dictionary, Canadian Edition*

Recently, my ninety-year-old mother discovered, quite by chance and to her great joy, a lady with whom she shared some twenty very close friends and had done so for over sixty years. Yet during all this time, neither knew of the other's existence. This chance discovery led to much joy and happiness. This simple story is an illustration of serendipity.

The ladies of this story can be thought of as the nodes in a network, and their friendships as the links in that network. The twenty-odd nodes were all interconnected with one exception, the link between one pair of nodes remained open for some sixty years.

The telephone system joins our telephones into a very large network. Whenever we place a call, we are invoking a potential link between a particular pair of telephone sets. One could imagine a telephone system that would match calling patterns, and offer calls to establish links that might logically exist if the callers only knew of their potential affinity. Such a smart telephone network would have recognized the missing link in our little story, and would have suggested that these two ladies might enjoy meeting each other, in view of their shared calling patterns.

Such a network might be termed a serendipity machine. However, many people would be concerned over the loss of privacy such a record keeping and matching would imply. Also, mere calling patterns are probably not sufficient to ensure fortunate results. The simple example does illustrate how an intelligent network can act as a serendipity machine. Let us now turn to the real problem and a possible strategy for its resolution.

The information market-place concept addresses the economic constraints in detail, and relies on pluralism to account for any other constraints that might be present. If there is a linguistic constraint also present, what problems might it create and how might they be addressed?

In a simple information market-place, about the only aid a user could invoke for assistance in finding information about which he knows little or nothing is the information broker or "information about information" entrepreneur. The problem is analogous to seeking something in the yellow pages without knowing what the thing is called. It is precisely this problem that could limit the usefulness of an information market-place, and constrain it to dealing with supplying information that is time-varying, but otherwise well defined, like the weather, the stock reports, the football scores, and other current news items. Although other data bases are accommodated, they would generate only a small amount of traffic, for as they become more useful to some, they become less "findable" to others. Essentially, we cannot describe information we might need when we do not know much about it. How much the information brokers could contribute to solving this problem with simple hierarchical descriptive material is very much open to question. Other strategies are available, given the computational power of the technology underlying the information market-place. The most exciting such strategy is an adaptation of an educational use of computers known as computer-aided learning.

We began this book with the observation that the new is usually perceived in terms of the old. This seems particularly so in the case of computer-aided learning, for what may be a whole new class of intelligent interactive information systems gets labelled as some kind of "teacher surrogate." In what follows, the larger aspects of computer-aided learning technology are of interest, and not the mere instructional ones.

Modern, sophisticated computer-aided learning systems collect masses of data about every interaction between the users and the system. Proper statistics are generated that aid the author in determining which parts of his material are working well and which need improvement. This was never the case with books or even with live teaching. The book is not interactive, and the data base represented by a class-room of students is too small. The computer-aided learning system can correlate data from thousands of students, and so provide an objective assessment that no author could ignore!

Such features would be natural for the information market-place. Because material in such a system is connected through a decision matrix controlled by the user's responses, only the relevant material is presented. The user is taken into a subject or data base by a path that he himself determines. The definitions of where he is going are computed from the way he responded to the past material and the route he took to get there. The linkages between the individual packages of information are now very complex, far richer than a simple hierarchical tree structure. Consequently, the map created by a user as he travels through the material becomes a definitive description of the individual user. This description is far more accurate and contains less linguistic ambiguity than any description that the user himself might create.

The maps or tracks created by users as they browse through information properly imbedded in such a system are useful in two ways. First, the system can easily calculate what might be the most appropriate information to be presented next. If rebuked, it can come up with alternatives with equal ease. Second, kindred users can be identified and communication paths established. It is this feature that gives the strategy its name, the serendipity machine.

The user of a CB radio can easily find someone to talk with, but in general, little common interest can be developed from such a contact, and so the medium is little better than striking up a conversation with the person standing next in line in the bus queue. The serendipity machine offers the potential of finding persons whose established and emerging interests closely match. The effect is a giant *learning web*, in Ivan Illich's words. Illich (1971) claims that the grouping together of students at similar levels of interest is the greatest stimulant to learning, and that is exactly what the serendipity machine would do. However, it does more. Illich assumes the principal objective is learning. Perhaps the principal objective ought to be to bring together like-minded individuals who can generate enough enthusiasm to get something started. Might not the end result be the use of the learning aspects of the serendipity machine to assist in discovering resonating human beings?

Today's communications networks require a very detailed, geographically oriented description of the port at which the person one wishes to contact resides. Before using such a network, one needs to be reasonably sure that the resulting contact will have some utility for both the one making the call and the one being called. The telephone network, as we now know it, is in this regard somewhat lacking in intelligence. The serendipity machine would overcome this really very great limitation. The mere social impact of such a development could be enormous, not to mention the potential economic benefits that could stem from the serendipitous coupling together of budding entrepreneurial spirits.

Only a network capable of performing the sophisticated chores of a well-developed computer-aided learning system, together with computer conferencing or messaging features, and which couples the two with well-thought-out algorithms, could provide the basis of the serendipity machine. Such a network is no trivial add-on to the existing telephone one, nor is it one that might be piggybacked onto some cable television system as a marginal addition. It is a major challenge to network architecture.

Lest there be some concern over privacy, such an intelligent network would have little difficulty in permitting the tracking feature to be turned on or shut off under customer control. Also, there is no reason why a single user could not appear as several distinct individuals, depending on the particular role he might wish to play. Only the billing facility would have to know who the real "wonderman" is. This practice is already emerging in small, game-oriented, computer-based services. An ego hit against one's *nom de plume* is easily survived. There is always a price that must be paid for privacy, and here it is in the accuracy with which the system can perform its matching. It boils down to a choice between stimulating communications or private isolation. Even Aristotle preferred the former.

IDEOGRAPHIC WRITING

The serendipity machine is one strategy that aims directly at the linguistic constraint. However, it addresses that constraint somewhat obliquely. A rather more straightforward approach would involve a direct attack on language itself. After twenty-five hundred years of the phonetic alphabet, perhaps it is time to review the potential of an iconic or ideographic language. Information technology now makes such a review propitious. This new technology is considerably more adept at dealing with the complexities of such linguistic forms and removes the principal problems.

The phonetic alphabet made it easy to teach reading and writing to whole populations. The simplicity of the system and its reliance on already-learned spoken language gave it this advantage over the more difficult ideographic forms. Today, computers can teach ideographic languages as easily as ordinary teachers can teach the phonetic forms of writing. Also, our communications facilities make it a simple matter to introduce new symbols. Our own spoken language demonstrates this with such new words as "astronaut," "radar," and the like. Hence, this new technology provides some significant advantages over the stick scratching in sand, which was the archetypal technology underlying the phonetic alphabet.

Bliss (1965) has described an ideographic language suitable for modern western civilizations. This language is currently being taught to verbally handicapped children in Ontario schools with exciting results. It has already been accommodated in an experimental, computer-based communications facility at the Communications Research Centre of the Canadian Department of Communications. It is as easy, or as difficult, to have a visual display unit associated with a computer reproduce the ideographic symbols of Bliss as it is to have it show any symbolic forms, the phonetic alphabet, for example.

Today's very complex Chinese writing, also ideographic, is the result of the stylization of the symbols carried out over thousands of years. This has complicated the whole process and turned the business of making the characters into an art form. This has not added to the ease with which the language can be used. Such sophistry would not occur were the language to develop within a computer-based medium.

For the last one hundred years, the telephone has been a rather poor system in terms of the fidelity with which it reproduces sounds. Its frequency response and distortion have made it unacceptable for the transmission of music, for example. This poor fidelity, although quite acceptable for exchanging spoken messages, constrains the utility of using sophisticated vocal techniques, such as are common in radio broadcasting. The fidelity of the medium is too poor to allow sophistication in articulation and vocalization to be effective. Consequently, attention is directed to the content rather than the form of speech. New technology now being introduced into the conventional telephone will cause the fidelity to improve, but the habits that have been established will likely preserve the importance of content over form. Should this change, the telephone would be in serious trouble.

Similarly, the rather simplistic graphical capability of computer-based graphics systems would make the utility of sophisticated calligraphy minimal. Hence, an ideographic language based on computer graphics would tend to concentrate attention on content rather than form. This is important for two reasons. First, it permits a relatively inexpensive system, and second, it preserves the conviviality, in Illich's sense, of the medium.

The cost of preserving the infinite variety of sophisticated calligraphy would be too high. It is much less expensive to transmit and store only the code for a particular symbol rather than the symbol itself. The symbol is then reconstructed at the receiving terminal from intelligence it has stored within itself. All that is required is agreement amongst all users as to the code required to produce the particular symbols. This has been accomplished for the phonetic alphabet, in the form of the ASCII code. This code relates particular letters to strings of eight binary bits. A similar, widely acknowleged code must be developed for the ideographic symbols.

As there are many more of these symbols than the mere 128 that are used in writing, the code would involve more bits than the eight used for our current printed material. By going to a sixteen-bit format, two eight-bit bytes, a very adequate repertoire of 16,000 unique ideographic characters could be accommodated, with two bits left over for housekeeping. In essence, the code could consist of pairs of standard alphanumeric symbols written in standard ASCII. Bliss claims his language is useable with only 100 symbols, and has high utility with a mere 400. Sixteen thousand should provide adequate room for expansion! So much for the code used by the machines for transmitting and storing the graphical symbols. It is merely twice as complex as that currently being used!

Storage and transmission costs are therefore only twice that for storing and transmitting the characters you are now reading. However, the theoretical information content carried by an ideographic character would be 128 times as great. Therefore, the overall storage and transmission costs for a complete document would be significantly reduced for ideographic material in comparison with the same content using our conventional phonetic format. Bliss claims a similar reduction in the paper requirements for documents written in his symbols on paper.

Writing in ideographic symbols may be harder to learn than reading such symbols. Bliss describes a typewriter keyboard for the preparation of such material, and if the appropriate keyboard were connected to the terminal described above, the problem would be solved. Authors' aids could be made available on demand from the network to which such terminals would be connected, providing an on-demand dictionary. Such a dictionary should be organized by concept, like *Roget's Thesaurus*. Alphabetical organization would be limiting, as this would limit the ideographic language to the same syntax and lexicon as spoken language, a limitation which the adoption of an ideographic language is designed to break.

It has been claimed that our phonetic language is a "left brain" function, with characteristics of linearity and analysis. In this two-half model of the brain, the ideographic language of fingers conversing with eyes would involve the "right half," the more intuitive, creative, and judgemental part of the brain. Brain lesion analysis of Korean war casualties demonstrated that different parts of the brain are used for phonetic and ideographic writing and reading skills. The two forms are clearly not mutually exclusive and are likely synergistic in combination.

In one sense, the significant achievement of the past one hundred years could be described as the creation of the "time-varying icon." Motion picture and television provide us not with the discrete pictures found on the cave wall, but rather with images that flow in time from one to another in sequence. The selection, the rhythm, the blending, the sequencing of these images transmits the meaning the producer desires. It is the flow that makes a movie work. Such techniques could be applied to an ideographic language as well, given the power of our new technology. Symbol could transform into symbol, with a flow and rhythm set by the author. This transformation could be very powerful indeed. Simple algorithms resident in the receiving terminal would provide the intermediate or transitional frames creating what might be described as a symbolic movie. Colour, size, and rate of the transformation from one symbol to the next then become variables under the command of the author. A movie could be literally created from a simple keyboard. The viewer could control the speed, slowing down or speeding up as his comprehension demands. Unlike recorded music, where changes in the pace of presentation introduced by the listener produce wild variations in pitch, these changes would not destroy the effect.

Information technology could easily achieve these objectives at a very reasonable cost, if we were to so choose. Terminals capable of creating and receiving such material would cost little more than a good quality colour television set. The facility required to store and transmit such material is virtually identical to that that would be required to serve the same purpose for our more conventional phonetic material. Using time-varying icons, the information market-place could very easily provide the technological environment for the emergence of a widely used ideographic language for only an insignificant increase in overall cost. The societal benefit could be immense. The existing linguistic barriers to communication would just dissolve for material written in the ideographic form. Bliss symbols transcend the barriers of spoken language. It was this property of Chinese writing that inspired Bliss in the first place. One could say that ideographic writing is Bliss!

Chapter Eight

A NEW MASS MEDIUM

The ideas presented in the preceding chapters can be combined into what might be described as a new communications medium. Although our notions of this new medium are still quite vague, it is not too early to attempt an assessment, for in doing so, the nebulous ideas will be shaped in directions that can only improve the medium's potential. In what follows, four assessment approaches will be explored, beginning with a technique published by the author in 1975. This method involves comparing the potential impacts of the new medium with those produced by some of our present communications media.

For the purposes of this analysis, we shall assume that a new, widely used mass medium, capable of doing the things outlined in the previous chapters, exists, and that it is used to such an extent that it has measurably impacted television viewing time. This would imply that the average person would use the medium on the order of an hour a day, with some users going as high as six to eight hours, as they would derive the principal portion of their income through interacting with the medium.

The analysis that follows is in a descriptive form. In the process, the definition of the new medium is clarified. More critical readers are directed to the reference material and are encouraged to perform their own analysis.

The impacts considered are those described in Thompson (1975), which are:

- An easing of the access to stored human experience for the society at large.
- An increase in the size of the common information space shared by the communicants (citizens).
- An increase in the ease with which shared feelings about new ideas could be discovered and developed. Nascent consensus was easier and cheaper to discover and develop.

In the following paragraphs, first the new medium, then the book and the telephone, and finally television are examined, using these impacts as a framework for discussion.

There is little doubt that such a new medium would significantly ease the access to stored human experience. The combination of easily accessed electronic storage, where material is presented in a fashion designed for quick absorption, with easy comprehension and good retentivity, using the best techniques of computer-aided learning and even ideographic writing, which has the attributes of speed reading, could only very much increase the data base citizens use in their everyday activities. In overall significance under this particular characteristic, this new medium would probably outstrip the printed book for potential importance. The serendipity machine features would help with the naming and indexing problems that limit the usefulness of more conventional means of accessing stored human experience.

Similarly, the new medium would rate high in terms of the size of the common information space the users can share. It encourages such sharing at the conceptual level through the serendipity machine, and carries right on through to the interactive real-time graphics capability such a medium would have. One activity that is very likely to grow, given this new medium, is the playing of sophisticated games, where the players are linked through the network and are supported by a shared computer. With the addition of a voice channel, such pastimes could become quite popular. The medium could select matched players so that the experience could be very rewarding, both from the sheer delight of the interaction and from the making of new acquaintances with shared interests. The "game" becomes a kind of shared space in which the players interact. The medium, in identifying suitably matched players, very much increases the opportunity for everyone to find satisfaction.

The serendipity machine features make the medium a superb aid in discovering and developing nascent consensus. Groupings of kindred souls could easily form. Things from innovation to revolution would be easier, and more of them would be happening. The cost of launching a new idea would be very much less; those that survived in this medium would progress from medium to medium, and if good enough, finally emerge in television, giving it a rich new source of ideas, people, and issues to develop still further towards higher levels of consensus.

It is hard to see how such a new medium could have a more powerful competitor for scoring under this assessment instrument. Three such competitors, the book, the telephone, and television, can be compared with it, using the three characteristics that form the basis of the assessment instrument.

The book, with its attendant library structures, publishing industries, and relatives, the newspaper and the magazine, certainly makes stored human experience widely and easily available. With its computer-aided profiling, this new medium would put a first class librarian at our individual disposal at all times. Reading is now perceived to be rather hard work, and is a poor loser to television as a claimant to discretionary time. The new medium, using tricks from the best of computer-aided learning, should redress the trend towards the ephemeral television medium. The new medium could challenge the book in terms of its potential to ease the access to stored human experience.

When two people subscribe to the same newspaper, a common data base is built up that they can share. However, if one asks us what we think about an article that appeared last week, chances are that we have thrown the paper out, and either we have forgotten the particular article, or we never bothered to read it in the first place. With the new medium proposed, it is an easy matter for us to catch up and restore that common information base so we can share some interaction about it. In this way, the new medium surpasses the print media in its ability to permit us to establish common intellectual information spaces. Except for those few people who write all over them, books offer little opportunity for interaction between individuals in any direct, albeit delayed or non-real time, mode. The new medium, with its interactive graphical mode, appears to be better than print.

Given the serendipity machine, nascent consensus is much easier to discover and develop with this new medium than it ever was with printing press technology. The pamphlet had to be thrust into many hands before it found a potentially sympathetic heart. Junk mail, son of the pamphlet of a hundred years ago, will hopefully fade away when it is easier to make useful hits that are appreciated by both the hunter and the target. So, the new medium seems to win out over the printing press and its products under all three of the impact areas.

Now, consider the telephone, and compare it to our new medium. The telephone does ease the access to stored human experience in that it is frequently easier to telephone an expert than search for the information wherever it might be. However, the telephone requires that one know who the expert is, and that he be accessible and not rebuff the call. Not so with this new medium. Its convivial indexing routines, involving browsing through the computer-aided learning material, and leaving behind a behaviourly determined profile, will make the new medium much better than the telephone for accessing stored human experience.

As a means of sharing a common information space, the telephone would win out over the new medium, unless the new medium incorporated a real-time interconnection featuring interactive graphical couplings along with the usual audio coupling of the telephone. The shared graphical space so created may have a truly great significance. This is the scribblephone concept that we presented a decade ago. It is a very powerful increase over the simple telephone in terms of the size of the common information space that communicants can share. In the long-term view, an ideographic language coupled with the real-time interactive graphics capability would allow cross-cultural real-time communications, English-French, Cree-Inuit, or whatever. Clearly, this very significantly enlarges the common information space that can be shared by enlarging the set of people that can share and interact.

It is interesting to postulate what the audio channel would be doing while the graphics one is being used for such interchanges. Learning a second spoken language may become very much easier through the use of a shared ideographic language over a scribblephone connection.

For discovering and developing nascent consensus, the telephone is somewhat cumbersome, and the serendipity machine, with its automatic linking, can easily outstrip it. On balance, the new medium wins hands down over the telephone.

Television, being almost totally ephemeral, contributes little to easing the access to stored human experience. It only succeeds here by pure serendipity. The new medium appears to win again.

With the scribblephone feature, the new medium is head and shoulders over television as a means of generating interaction through the identification and creation of common information spaces that can be shared by communicants.

Television is a fine medium for building large consensuses, ones that involve large percentages of the population. It is just not applicable for the tender beginnings of the consensus process where only a few are aware of the new idea. Television and this new medium deal with different aspects of the consensus process. But it is the tender beginnings that are of significance in the assessment instrument's rating scheme, and so here again the new medium wins.

The new information market-place medium, with the serendipity machine, the potential for an ideographic language, and the scribblephone features, wins out over the printing press and its descendants, the telephone and television, in terms of the three characteristics that were found to be present in all previous significant communications revolutions, based on the commonalities present in their impacts. It follows, therefore, that this new medium has the potential of being a significant communications revolution, with important higher-order impacts.

The communications assessment instrument also seeks an assessment of the range of expected impacts over a continuum ranging from social welfare, through economic opportunity and economic necessity, on to survival. The thesis is that an innovation gains in importance the more its impacts are seen to diffuse across the continuum. The fraction of the impacted population that perceives the innovation's impacts in a particular domain of the continuum is used to provide a numerical score for each of the four domains.

The social welfare derived from the ubiquitous availability of a means of establishing good cross-cultural communications would be perceived by the entire impacted population. Furthermore, the benefits of the serendipity machine, the educational benefits, and the improvements brought about by the re-establishment of a recallable means of transmitting culture would also be widely experienced. This new medium would have to be given a full score here.

Economic opportunity would be quite widely perceived as the medium gained acceptance. The underlying economic aspects of the information market-place are designed to promote just such a wide perception. Hence, a good score is obtained here as well.

Economic necessity relates to the deprivation one might feel were he denied the facility. Would his normal arrangements for earning a living likely be hindered by such a denial? The telephone has certainly achieved significance here, and in time, this new medium will likely also score highly. The availability of good, non-real-time messaging features, and other services, such as text and other editing aids, would clearly enhance the probability of a healthy score.

Survival has many aspects. At first, this new medium may not appear related to the issue of survival, but as time goes on, that will likely alter. Survival as a society may well depend on shifting a significant portion of our economic transactions from the exchanging of hard goods towards the exchanging of more ethereal goods. This new medium is designed to encourage such a shift. At the individual level, good medical reference material and other aids to coping with the daily emergencies may become important enough as to give it a very good rating here also.

In short, it is hard to argue that such a new mass medium could be insignificant, for not only do the potential impacts range across the entire continuum, but they appear to have solid depth in each of the four domains.

Let us now turn to some ways of assessing communications innovations that lie beyond the technique described above. First, we shall consider the innovation in terms of its potential to impact the "wealth creating" processes of our society. Second, we shall examine how the new medium might impact personal-time budgets.

The major communications revolutions of the past appeared to open, for a period, the normally closed economic system within which they emerged. A closed economic system predominantly features the zero-sum, or "I win, you lose," game. An open system leads to the "everyone wins" syndrome. The great communication innovations of the past seem to have led to an opening of the otherwise closed economic system in which they appeared. Such a shift in the nature of an economy represents a profound increase in wealth for that society. The hundred golden years in Athens appear to have been at least enabled by the widespread use of the new technology of writing. The printing press likewise enabled the Renaissance. Today, we could use a similar expansion. If any communications innovation can enable, trigger, or stimulate such a development, there seems no better candidate than this new medium with its intelligent network and intelligent terminals. Information technology could be the catalyst for yet another great age of man. How does one do a cost benefit analysis for such an opportunity?

In the second paragraph of this chapter, we assumed that the average person would use this new medium for an hour or so each day. Let us now turn to an examination of this assumption. Staffan B. Linder (1970) builds a simple economics of consumption, arguing that since time is the one final constraint acting on us all, a consumer must adjust this time-allocation budget to reflect utility for new consumption items. Expanding his argument to our case, users would have to spend significant quantities of time using this new medium if there were to be economically significant revenues flowing from these usages. For the electronic information market-place to mean anything economically, people will have to spend time in that market-place. Not just fleeting moments, but "chunks" of time. This simple fact almost always is overlooked in literature on the "new services." The question we must ask is what would the average user do for an hour or so each day on such a medium? The usual lists in the literature are inadequate in answering this question in a realistic way. Utility, and hence demand, can only build when the content in the system is sufficiently appealing to successfully capture the average person for an hour or so every day.

If the content of this new medium should be so compelling that we do spend an hour or so each with it, then clearly any constraints, be they economic or linguistic, will have been largely overcome. On the other hand, it is difficult to argue that such a condition could be achieved by ignoring the deeper concepts of language and economics. In earlier chapters we established that these were the source of constraints on our ability to apply this new technology in ways of massive socio-economic benefit. The particular features described in the previous chapters were developed to specifically address these problems, hence this new medium should be able to attract a content that is winning enough to produce high levels of usage.

If this new technology can be used in such a way as to shift increasing amounts of economic activity away from the exchanging of energy-intensive hard goods towards utilitarian exchanges of mere ethereal experiences or information, perhaps we could achieve Gilboy's rising real-wage condition. Such ethereal transactions would allow a continuing increase in economic activity that would largely dodge the dilemmas of the *problématique* outlined earlier. There appears to be no other way of achieving this rather desirable end. Is the cultural learning that stemmed from the incredible success of the mercantile and industrial systems blinding us to the opportunities presented by this new information technology and all that it implies? This is what our rather simple socio-economic model of chapter two would suggest. Bearing in mind the biases we bring from this cultural learning, let us now examine how well the new medium might help us redress the *problématique* of chapter two.

THE *PROBLÉMATIQUE*

The first dilemma was the one of growth, which arises from our need for continued economic growth, and the resource limitations that inhibit such growth. To the extent that the information market-place sustains transactions that involve only information or ethereal goods, and do not culminate in the exchange of some physical good, we provide a sector for economic growth that can largely escape the limitations of conventional resources. As to the exact nature of the transactions that will make up this growth, we can only claim that specific examples would be as irrelevant as the making of pins is to the manufacturing of automobiles. We can make statements about the form of these transactions and the kind of infrastructure that is likely to support them, but the prediction of their exact nature is most likely to be way off target. Perhaps sophisticated, computer-based interactive games involving several, and in some cases many, players might be a useful example. However, in all likelihood, this example may be important only in the beginning stages, as was the publication of religious books in the early life of the printing press. The potential for entrepreneurial activity and expansion in this medium is for all practical purposes bounded only by the labour shortages such opportunities may create in the other more physical activities that are necessary for the sustenance of societal life. We should have such a problem!

The addressing of the control and distribution dilemmas is somewhat more indirect and involves the communications aspect of this new medium. Stafford Beer (1975) describes how an intelligent communications environment that has modelling features could lead to a much more satisfactory distribution of resources than is now achieved by either our economic or political systems as we know them. Very entertaining games can be built around simulations of the control and distribution dilemmas, making the general population far more knowledgeable about the intricacies of these dilemmas, thus forcing our institutions into higher levels of performance in solving the problems. Hopefully, western politicians have evolved enough to permit such developments without the response they brought to bear on Chile, the first country to try such techniques. Perhaps if this powerful technology is first appreciated as a mere toy, it can later be accepted as the powerful tool it is. This may be the only socially acceptable route for the evolution to take. The telephone had to become part of the everyday social fabric before it really impacted our established institutions. Schoolrooms still do not have telephones!

To the extent that the growth dilemma is resolved, the job-roles one is also ameliorated. The occupation of "information entrepreneur" will be as socially acceptable as any job in the present-day information sector. Because this activity favours the small, independent producer, this new occupation may be even more respected, for the one who succeeds here is not riding on some corporate gravy train. His reward is earned in a real, competitive market. His income is a direct measure of his wit and talent, as perceived by the society at large. A particularly successful individual in this activity is likely to rank along with the local politicians, authors, and conventional media people, ahead of the local car salesman.

Hopefully, the utility and satisfaction of participation in the activities of this new exchange medium would reduce the demand for unnecessary physical goods. It should clearly contribute to increasing the actual utility of those hard goods that are purchased by increasing the quality of consumer information about hard goods that is available, and making it easier to access and use. Advertising, as the funder of other mass media, may be profoundly impacted, for it will be much more difficult to overcome shortcomings in product quality by means of a powerful advertising campaign.

In summary, this new medium, when it becomes widespread enough to be ubiquitous, might redress all five of the dilemmas of the *problématique*. New dilemmas will doubtless arise, giving future generations a new level of problems to face. There is no utopia, only an evolving sequence of approaches and redefinitions.

CONCLUSION

We have seen how the trading ethos, established under the mercantile system, grew and prospered with the adoption of industrial technology. The transition, in economic terms, from the mercantile to the industrial system was hardly revolutionary, but was rather more evolutionary. The new technology matched the legal, economic, and other infrastructures established under the earlier patterns of exchange.

The dullness of our economy today was seen to be an indication of the saturation of the practices developed during the period of mercantilism and industrialism. Further major growth cannot occur without extending into new market-places, and the concept of an information market-place was introduced as the only reasonable and viable candidate for sustaining the required growth.

Information technology, although resemblant in some ways, is quite different from industrial technology in very important respects. We postulated that these differences, and the opportunities they might contain, are largely hidden from us because of the intense learning we have experienced with the trading of goods produced with the aid of industrial technology.

Information technology, it was argued, differs from industrial technology in both form and content. The new technology's form leads towards negation of the big-is-beautiful and similar industrial ideas. Information, as the content of this new technology, is a somewhat recalcitrant economic good, and great care must be exercised if we wish to develop market-places in which this good can be exchanged in a wealth-creating and economically satisfying way. It was pointed out how the technology chosen for the basis of an information system can have profound socio-economic consequences by determining the private or public state of the economic behaviour of the information content, and hence the character of the market-place and its ability to produce the requisite socio-economic benefits. In a free-market society, an inept decision here could be disastrous.

The key hypothesis was advanced that the more transformative wealth-creating class of innovative applications of this new technology appears inhibited by some constraining factors. These factors were identified as stemming from two sources: (1) our perceptions of utility and wealth, or in a word, economics; and (2) our use of language. It was argued that these constraints acted to limit the development of a massive demand pull on this new technology, hence limiting its potential to significantly ameliorate our present economic problems stemming from wanting too much from an economy that is becoming, in a very real way, supply or resource limited.

Strategies designed to optimize the socio-economic benefit from the use of information technology were advanced for the near, intermediate, and longer-term future. These ranged from the establishment of an information market-place, housed in some new kind of mass medium based on this new technology, through the description of how a more intelligent interconnecting network could more fully serve ordinary people, to the idea of this new technology providing us with the opportunity to adopt additional linguistic techniques.

In the final analysis, if the demand-limiting constraint hypothesis of chapter three has validity, then great care will have to be exercised in order that our early and probably simplistic attempts at building new "super systems" demonstrate even the smallest amount of utility for the average person. It is not going to be easy. The technical problems pale before those that are likely to be involved in actually developing the infrastructures, content forms, royalty policies, and the like that will ensure success.

Unlike Hero's steam engine, information technology will not lie unused for centuries. The question of importance is whether this technology can be used in imaginative and creative ways to ameliorate, rather than exacerbate, our present condition. It is my thesis that, if we apply this new technology as if it were just more of the older, more familiar kind, we can only expect an intensification of our present problems. In short, the choice is between a hyperintensification of the zero-sum economic game played in an arena of diminishing resources or the opportunity to open up new games of the "everybody wins" class. Information technology may be the key to coping with abundance.

BIBLIOGRAPHY

Bar-Hillel, Yehoshua. 1964. *Language and Information: Selected Essays on Their Theory and Application.* Reading, Mass.: Addison-Wesley Publishing Co.

Beer, Stafford. 1975. *Platform for Change.* New York: John Wiley and Sons.

Bliss, Charles K. 1965. *Sementography (Blissymbolics).* 2d ed. Sydney, Australia: Sementography (Blissymbolics) Publications.

Brown, Lloyd A. 1956. "The Longitude." In *The World of Mathematics.* 4 vols. New York: Simon and Schuster.

Burke, F. Eric. 1972. "Constraint Models in Long-Range Strategy Forecasting." In *Operational Research in Industrial Systems*, edited by J. Brennan. London: English Universities Press.

De Sola Pool, Ithiel. 1977. "The Social Effects of the Telephone." In *The Telephone's First Century and Beyond*, edited by Jerome Weisner et al. New York: Thomas Y. Crowell Co.

Galbraith, John Kenneth. 1975. *Money: Whence It Came, Where It Went.* Boston: Houghton Mifflin Co.

Galbraith, John Kenneth. 1977. *The Age of Uncertainty.* Boston: Houghton Mifflin Co.

Gilboy, Elizabeth W. 1972. "The Cost of Living and Real Wages in Eighteenth Century England." In *Europe and the Industrial Revolution*, edited by Sima Lieberman. Cambridge, Mass.: Schenkman Publishing Co.

Harman, Willis W. 1977. "The Coming Transformation." *The Futurist*, February, pp. 4-12.

Havelock, Eric A. 1963. *Preface to Plato.* Cambridge, Mass.: Harvard University Press, Belknap Press.

Illich, Ivan. 1971. *De-Schooling Society.* Edited by Ruth N. Anshen. New York: Harper and Row Publishers.

Illich, Ivan. 1973. *Tools for Conviviality.* New York: Harper and Row Publishers.

Kuhn, Thomas S. 1962. *Structure of Scientific Revolutions.* Chicago: University of Chicago Press.

Linder, Staffan B. 1970. *Harried Leisure Class.* New York and London: Columbia University Press.

Masuda, Yoneji. 1975. "The Conceptual Framework of Information Economics." *IEEE Transactions on Communications*, October.

Parker, Edwin B. 1976. "Social Implications of Computer/Telecoms Systems." *Telecommunications Policy* 1, December.

Porat, Marc U. 1977. *The Information Economy: Definition and Measurement.* Washington, D.C.: Government Printing Office.

Russell, Bertrand. 1959. *Wisdom of the West.* Los Angeles: Crescent Books.

Slater, Philip E. 1970. *The Pursuit of Loneliness: American Culture at the Breaking Point.* Boston: Beacon Press.

Thompson, Gordon B. 1968. "Scribblephone--Extending Man's Powers of Communication." *Telesis*, September.

Thompson, Gordon B. 1970. "Moloch or Aquarius?" *The 4*, February.

Thompson, Gordon B. 1975. "An Assessment Methodology for Evaluating Communications Innovations." *IEEE Transactions on Communications*, October.

Thompson, Gordon B. 1977. "Future Mass Media." In *Report of the Royal Commission on Violence in the Communications Industry*. Vol. 7. Toronto: Queen's Printer.

White, Lynn, Jr. 1962. *Medieval Technology and Social Change*. New York: Oxford University Press.

Winner, Langdon. 1977. *Autonomous Technology: Technics-Out-of-Control As a Theme in Political Thought*. Cambridge, Mass.: M.I.T. Press.

Zipf, George Kingsley. 1965. *Human Behavior and the Principle of Least Effort: In Introduction to Human Ecology*. 1949. Reprint. New York: Hafner Publishing Co.